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"A technical training by itself is insufficient. It is imperative that our students get a broad, comprehensive education. When technical education is too narrow, it tends to restrict the development of leaders. Engineers, scientists, physicians and other professional men often are called upon to assume important positions of leadership in the community. Unless they are aware of the major issues of the world, they may find it difficult to give competent direction . . . The colleges have a profound responsibility to develop men and women who are not only skilled technicians but alert, intelligent citizens. No college can blink at the fact that a man must have something more than professional competence."—Dr. James R. Killian, Jr., President of Massachusets Institute of Technology.

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The 1949 Pharmacy Seminar–The Objectives*

(Held at the University of Wisconsin, June 27 to July 8)

The educational philosophy on which seminars are based has been demonstrated to be sound by groups in various areas. These group discussions have been held under various names such as workshops, conferences, short courses, etc. However, regardless of designation, the purposes and objectives are fundamentally the same; namely, to improve teaching in the particular area concerned. This idea is not new in pharmacy. It has been practiced by the American Pharmaceutical Association by means of sections for teachers, by the American Association of Colleges of Pharmacy by means of Teachers' Conferences and, likewise, by means of the Plant Science Seminar. Hence, the functional value of seminars has been clearly demonstrated in pharmacy as well as in other branches of education.

This seminar in pharmacy, now about to begin, is actually a part of the implementation program of The Pharmaceutical Survey. It is my impression that it is intended to serve two purposes; namely, first to present and make clear to teachers of pharmacy the newer facts and concepts concerning subject matter to be included in the area of pharmacy, and second to arrange this subject matter in organized courses in the curriculum to assure a logical presentation in the colleges. The success of the seminar remains to be demonstrated. The success of the seminar will be determined by the extent to which the material presented is utilized and effectively applied in the teaching of these men in the pharmacy area.

*The purpose of the publication of this series of papers is to bring to the whole body of pharmaceutical educators not only the subject matter content of the Seminar, but, insofar as possible, the spirit also. We would like to publish in full the paper of every participant in the program, but that was found to be impossible, because of financial limitations. Only those articles by the guest speakers are published in their entirety. By "guest speakers" is meant those who took part in the program, but who are not members of the pharmacy faculties. The contribution of these men to the success of the program was tremendous. Most of the other papers are presented in abstract or tabular form, so as to show their content and give the reader a clear-cut idea of what was presented at the Seminar. A few of the non-guest papers are printed more completely than others, because they deal with newer fields, such as hospital pharmacy and the teaching of the history of pharmacy—where methods are so greatly needed in the development of good teaching. The Editor assumes all responsibility for the selection.—Ed.

It also should be pointed out that this seminar is made possible by a grant of funds to the American Association of Colleges of Pharmacy by the American Foundation for Pharmaceutical Education. For this support and sympathetic interest, the members of the seminar and the officers and members of the college association, I feel confident, are deeply appreciative.

I also feel assured that everyone attending the seminar will enjoy and be greatly benefited by the discussions presented during the entire program.

Comments concerning the plans for the program as a whole have been most favorable. Apparently, the presentations and discussions will be of a high order and challenging in character. It is evident that the committees in charge and the teaching staff have worked hard and conscientiously, and it is a pleasure and a privilege to express to them the thanks and appreciation of the officers and members of the college association for a job well done.

Bernard V. Christensen, President
American Association of Colleges of Pharmacy

Some Fundamental Psychological Principles of Learning

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Introduction

Higher educational institutions have an adopted scheme or educational policy. These institutions also have an appropriate organization for realizing this scheme. The teaching staff, individually and collectively, is to bring about the realization of the plan. Teaching is a means of executing an institutional plan

of education. In addition to this executive responsibility, the teacher himself, is a designer of that part of the plan which he executes. In a very real sense, he develops his own immediate objectives, he selects materials, and he presents stimuli apropos to the accomplishment of these objectives. One of the major responsibilities of a teacher is that of the presentation of proper stimuli. The stimuli he has selected, ordered and presented must direct the learning of the students in accordance with the adopted scheme.

Each teacher works out and executes his own design for education realizing at all times that his part must fit into the larger institutional plan.

Teaching, then is the fostering of the education of any individual by the direct presentation of stimuli. It may not be said, however, that techniques of presentation of stimuli for all teachers is or can be the same. The individual methods of one successful teacher may be valueless when used by another. Also the same stimuli will not get the same response from all students. The specific methods developed by any teacher are more likely to be successful if that teacher bases them on present knowledge of the process of learning.

LEARNING

At present there are several conceptions of learning, however, the one most commonly accepted by psychologists is that learning or other behavior occurs in satisfaction of some need for the organism. It is observed, from this statement, that any learning situation consists of mainly the learner and the learning environment.

Learner

The learner is to be considered first.

The learner is recognized as an individual with: (1) tendencies toward activity; (2) the ability to react in terms of annoy-

ance or satisfaction to the consequences of his own activity; (3) the ability to reflect; (4) the ability to generalize; and (5) the ability to develop attitudes which he may describe as a feeling of satisfaction, adjustment, dissatisfaction or disturbance.

The limiting factor in achieving any learning is the degree of maturation of the learner. Has the learner reached the proper level of physical maturity at the time the learning situation is encountered? Has the learner, as a result of previous learning, reached the proper level of mental development?

The physical condition of the learner is also a factor in determining his ability to learn. Is the learner physically capable of receiving the stimuli? Stimuli are received through sight, sound, smell, touch and taste. The proper functioning of the sensory receptors is essential if learning is to result.

Another factor usually ignored is the health of the learner. Is he fatigued, drugged, nervous, or malnourished?

Learning Environment

The second element to be considered is the learning environment. This includes both the physical and psychological environments.

The physical environment, as temperature, humidity, light, seating, visibility, and ventilation are known to be important, but it is believed that the psychological environment is even more significant.

It is said that at any level of maturity the learner is ready to learn anything that is within his mental, physical, or social range provided appropriate stimuli are present. Recall if you will that the learner is an active individual. With this in mind, the provision of adequate or appropriate stimuli includes a means of starting the action. This is often stated as, "How can we produce an environment that will motivate the student to act in the desired way?"

Motivation

Many master teachers and psychologists believe that motivation is the very heart of the learning process. Prerequisite to effort is interest. Learning is the result of activities set in motion by incentive, purpose or drive. The maintenance of interest and enthusiasm at a high level should be a major concern of all teachers.

Motivation may be extrinsic or intrinsic. When the student is bound to his work by interest in the activities themselves, it is said to be intrinsic. In this case the subject matter of the course is made meaningful to the student. The reward for learning is learning The engagement of the student in purposeful activity because of its recognized worthwhileness is the ideal of teaching.

For several reasons this ideal situation is not always realized. Most teachers are forced, at times, to resort to extrinsic methods of motivation. Some of the most common forms are:

1. **Rewards and Punishments.** The reward should be a job well done. The failure to do a job because of lack of effort should have its own punishment. This also, is unfortunately not always the case. Teachers at all levels are using artificial rewards and punishments. A good grade is a reward. A poor grade is a punishment. Being passed on to a more advanced class is a reward. To be compelled to repeat is a punishment. Others are: being dropped from school, admission to a fraternity, class honors, a visit to the dean, state boards, and regents' examinations.

2. **Rivalry.** Rivalry with one's self is valuable. Rivalry among individuals within the same class or among classes, unless carefully administered, often leads to resentments and may prove dangerous.

3. **Praise and Blame.** It seems that, regardless of age or sex, praise is a more effective stimulant than blame or reproof. A word of encouragement rather than discouragement should be given to the struggling student whenever possible. A man is entitled to as many pats on the back as he is kicks in the pants, some one has said. Pick out the right things he does, not the wrong ones.

4. **Knowledge of the goal.** Knowledge of the goal to be attained

has been found to stimulate students to put forth a more continuous effort. If the student knows where he is going he is more likely to arrive. It gives him a conscious objective.

5. Progress. Knowledge of progress toward the goal has been found to be a stimulant to further effort. Nothing succeeds like a little success. The student will be carried on to further effort if he is able to see that he is accomplishing something. Frequent failures discourage most students.

It may be advantageous to bring some of the principles thus far mentioned together to form some coherent generalization.

Learning occurs through response of the learner to stimuli. This would indicate that learning is a process of readjustment. The learner is changed only when conditions of the environment demand the desired response. Learning is the modification of behavior through experience and training. The learner learns when he needs to learn. This occurs when his present pattern of behavior is no longer adequate. Changes in the performance of the individual occur in the process of attaining goals or satisfying desires. If we agree to all this we must refer to both overt action and mental processes as thinking when considering learning. Also, this would seem to deny the belief that learning is a process of absorption, adsorption or record making.

Reorganization of Experience

Each time an individual learns he is not learning something new. In many cases the greater share of the learning is the result of the process of organization or reorganization of past experience. This is done by discovering or developing new meaningful relations. As learning takes place new relations are established; new patterns of experience are organized. From these emerge new meanings, new understandings and new insights. The more common types of relations are: casual, spatial, proximity, part-whole and temporal.

Problem Solving

Recently the major emphasis has been placed on problem solving as a means of learning. It is found that learning is more

effective when it takes place through the solving of significant problems. This is also a reaction against the view that learning is the accumulation of facts. Students enjoy solving problems when they see their significance. They are able to overcome many seemingly insurmountable difficulties. In addition to learning facts they are building habits, skills, attitudes and appreciations. Through problem solving, attempts are made to formulate a pattern of behavior or a pattern of action advantageous to all individuals.

In discussing the psychology of learning the question of what to teach, what knowledge is of most worth, has a place of predominance. To this question, the following is the answer. Knowledge that has been and that can be tested for truthfulness or validity is essential in education as a basis for problem solving and for understanding. Functional knowledge is a force carryng the learner forward in the process of acquiring new functional knowledge. Learning takes place as a process of integration of the ideas that are the products of real experience.

That individuals differ is pointed out by reflecting upon some students ability to solve problems. Some individuals can survey a situation and decide, with little or no hesitation, what needs to be done to get the desired results. They are able to pick out the salient factors and the proper act at once. These individuals are said to have insight or understanding. The insight or understanding is dependent upon an adequate background of experience in that area. They have had sufficient previous learning to provide the solution to the problem. In addition they have the ability to analyze and reorganize their experience. If this were not true their discovery of the solution to a problem would be pure chance.

Aspiration Level

For learning to be most effective, the learner's activity must be directed toward desirable ends and at a high energy level. One of the fundamental techniques is that of managing situations so that the learner understands how the new behavior or adaptation will help in attaining his major goal.

If the level of effort is to be maintained the individual must enjoy some successes. Success on the part of the learner will be determined by his level of aspiration. It is important therefore, that the level of aspiration be commensurate with the ability of the learner if the maximum development is to be attained.

Satisfaction

To further add to the effectiveness of learning it is important to consider the effect of the learning on the learner. If the response is ineffective it will be eliminated eventually from the pattern of behavior.

Also, if the student has the desire to learn, but not the background of experience, this will cause the student to fail and probably block further learning. If he has the desire and the background and is denied the right or opportunity, this too may cause dissatisfaction.

Use

If the product of learning is never used it will eventually be forgotten. This is proper since it probably should never have been learned at all.

From the above statements it is apparent that need, purpose, satisfaction, activity and maturity are essential concepts in the psychology of learning.

Forms of Learning

The forms of learning most commonly described are: motor skills, perception, memorizing, understanding, problem solving, thinking, attitudes and appreciations.

Motor Skills

In order to efficiently develop a motor skill it is important to have a good start. A good teacher will take care to direct the efforts of the learner at the beginning. Proper initial instruction not only saves time, but also helps to prevent the development of

wrong habits. Wrong habits are often overcome only with great difficulty. It is easier to form a new habit than break an old one.

In some cases of motor learning a clear verbal explanation is adequate. Simply telling the learner what to do and how to do it may be sufficient. This is dependent upon the learners ability to grasp and retain instructions. It will require a background of experience or knowledge to comprehend what is told. It will require adequate attention to the explanation and memory for the essential details of the instructions. The purpose of the instructions is to give the learner a clear idea of what to do.

Verbal instructions are effective in calling forth the familiar actions in new situations.

If verbal instructions or descriptions are not adequate to develop a clear idea of what to do, the instructor will have to show him. In giving a demonstration be sure the learner is in a position to observe the details. Demonstrations are effective because the learner seems to imitate the general pattern of activity.

Sometimes manual guidance of the learner's movements by the instructor may be effective and applicable. This is effective since some individuals are more dependent upon kinesthesis than others in learning movements. It is most effective when the learner assumes a positive thinking attitude while being guided. This guidance can be continued too long. Independent activity is a primary requirement for learning.

Teaching experience and experimental evidence indicate that when an individual is being directed concerning the form of his activity, he should be told what to do not what not to do. Directions should be positive.

Even when one has the benefit of good clear instructions and good demonstrations accompanied by a real desire to learn, the early attempts are likely to result in relatively poor performance. There will be false moves and a general diffusion of effort. This will lead to disappointment, strain and fatigue. The learner is

anxious and muscles are tense so he fails to coordinate. He may resort to trial and error learning because he has forgotten the instructions. It is relatively easy to tell the learner what he must do to improve. Some of these would be: (1) eliminate false motions; (2) reduce tensions; (3) substitute efficient responses for awkward and clumsy acts; (4) correct and eliminate errors; and (5) coordinate all those movements which help to bring him to his goal with the least effort in the shortest time.

If the learner is to improve he must profit from his mistakes. To profit from his mistakes he must recognize them as mistakes and eliminate them. The teacher can help here by pointing out the mistakes and indicating the correct procedure. Good criticism by the teacher is helpful to the student. Good criticism is specific, constructive and encouraging. Good criticism is never fault finding, rather it should always point the way to better performance. The teacher must avoid antagonizing or discouraging the student.

To be most valuable a skill should be learned under conditions similar to those that will attend its later use. Practice under the conditions of use will aid the student in becoming proficient in the skill.

During initial learning and practice of a skill the learner must put forth honest effort. Complacency and satisfaction with the achieved results cause effort to slump. The level of aspiration of the student must be commensurate with his ability if the highest level is to be achieved. Over stimulation, anxiety or fear dissipate energy and therefore retard learning.

For relatively simple skills the whole method of learning is superior to the part method. For complex and difficult skills use a combination of the whole and part or progressive methods of practice. The practice periods for complex and difficult skills should not exceed 30 minutes and usually only two periods per day. Distributed practice is generally considered superior to massed practice.

Perceptual Learning

A large part of our learning is accomplished through perception. This is sometimes called a fundamental psychological activity. When we perceive we apprehend objects or events. We translate impressions made upon our senses into awareness of objects or events. The processes through which we become aware of objects or events are collectively called perception. We learn directly about things by observing them. Perception is essential to learning by imitation. Through perception we learn. Without perception there could be no learning except of a primitive sort. We also learn to perceive.

Perception is sometimes described as a process of getting knowledge of the physical world. Some of the essential features of perception are sensory experience, meaning, sensory discrimination and the forming of the sensory field into a pattern.

It is noted that perceptions are dependent upon a sensory experience. These experiences may be auditory, olfactory, visual, or tactile. In order for the sensory experience to have meaning we must learn. A retort to the senses is only a hard object of a peculiar shape. After the individual learns what a retort is and how it is used it begins to have meaning. The relation between sensory experience and meaning is the result of learning.

The experience of odor, color, taste, etc., appear without learning. When we can identify them as blue, hydrogen sulfide or whatever it may be, they have meaning. They have meaning as a result of learning. We have learned to perceive the objects, odors, sounds, etc.

After meaning has been developed in a sensory experience the experience must be organized into patterns. These various sensory stimuli blend into one another. In order for these patterns to form, the individual must have the ability of sensory discrimnation. The greater the differences distinguishable in the quality of sensory experiences, the greater is the possibility of making distinctions in perception.

As a result of practice, the perception of a total situation may be reduced to a few cues as stimuli. In this reduction of stimuli the cue stands for the whole and renders the same perception.

Perceptual abilities may be developed by repeated perceiving. What we perceive is the result of our past experiences. An aspirin tablet means more to the trained pharmacist than it does to the layman. Problem solving thinking also aids in the development of perceptions. Perceptions can be made more reliable by training the individual to observe. Directing his observations is one method. The use of natural objects, models, charts, drawings, movies, etc., is helpful in developing perceptions.

A factor of no little value when considering the development of perceptions is that of attention. The organism does its own selecting of stimuli. The selection is made on the basis of its needs or desires at the moment or on the strength of the stimuli. Some of the external factors found to be attention getters are novel situations, moving objects, and changing stimuli. The interests of individuals are also factors in determining attention.

Perception is of unestimated value in any science because the scientist seeks to discover facts and not to prove a point. He checks and rechecks his observations. Even though he is not infallible, the products of his perceptions are more reliable and exact than most non- scientific material.

Memorizing

We have noted that through perception we become aware of objects or events. If these experiences have been meaningful they will be remembered. When any object or event is remembered it is apprehended in the past. A perception leads to a memory and one memory leads to another. Those things experienced together in perception tend to be thought of together in memory. We associate acid with sour and red litmus.

We also form many verbal associations. The words whether

oral or written are symbols of objects or experiences. The formation of verbal associations is largely a matter of memorizing.

Learning is described by many as the development, altering or strengthening of associations. Associations are most often established by perceptions of objects or events in a sequence. As a result of further experiences the associations may be altered many times. The use, if only a restatement in memory, of an associative trend tends to strengthen it.

Memorizing occupies a place of considerable importance in our schools. All too often it is the end result of the educative process rather than comprehension or understanding. Memorizing can be justified in many instances because of the necessity of ready made responses. Fixed associations have a definite place in many areas. In computing the quantities of material to be included in a medical compound it is wasteful to go to a book and work out the tables convertng cubic centimeters to ounces or minims. Spelling also involves memorizing the letters of a word in proper order.

Sometimes one appearance of a combination of experiences is sufficient to set up a lasting association. This unfortunately is not always true. It has been found that repetitions are often necessary. For best results the repetitions should be distributed rather than massed. The optimal length of practice periods and distribution of these periods depends upon the material to be memorized.

If these practice periods are to be valuable to the learner he must be intent to learn. He must have a goal set for himself. He must have confidence that he can memorize the material. The repetition must be accompanied by attention. The material must have meaning for the learner.

For the best retention of memorized material it should be overlearned. The material should be repeated as often as recitation is possible.

It is pointed out that repetition alone is not sufficient in memorizing material.

Understanding

What we understand of a topic is what we think about it. It consists of many associations developed through previous experiences. Understanding or comprehension is an organizing or synthesizing process that integrates experiences into meaningful units. We apprehend objects in perception, but comprehend topics. A topic is an organized coherent unit of knowledge. It may be a law, a definition, a principle or concept. Comprehending, as a form of learning, is the building up of sequential associations. Through comprehension the student acquires an understanding of distillation. To one untrained in medicine, a bottle of cough syrup is something to take for a cough. To one who has an understanding of this, it means the compounding of several drugs in proportions which will be tolerated by the individual. He knows the effect of the drugs on the body. He knows which ones will be helpful and which ones will be harmful.

No matter what or where we teach we spend a large part of our time explaining, prescribing reading, planning demonstrations, etc., with the expectation that through comprehension our students will become better informed. We hope they will develop or acquire better understanding of the topics at hand.

It has been found that comprehension proceeds from vague impressions to clear distinctions; from a few associations to many. Topics are developed through rich experiences, by the differentiating of the details of the experience and the integration of the details into a unit.

In acquiring knowledge we may enrich the present knowledge through new experiences or, we may develop entirely new topics. In either case we must be cognizant of the present knowledge of the learner. His present knowledge is the only foundation upon which we have to build.

As we continue to learn our comprehension of any topic changes. Our manner of thinking about a subject changes. We tend to eliminate false or erroneous impressions and substitute in their place new impressions. The new impressions are then integrated into the new comprehension of the topic.

A great deal of our learning is acquired through hearing or seeing experiences. More is probably learned through reading and listening to words than any other. In this the present level of understanding of the student is obviously important. Is his listening vocabulary adequate? Is his ability to decode the complex sentences used, sufficiently well developed? Is his reading vocabulary adequate? Do the words used mean the same thing to both student and teacher? These are some of the most common sources of difficulty for the student. If they are not considered and modifications made in the teaching process when difficulties arise the students will verbalize. They will parrot back phrases without any understanding of their meaning.

In developing comprehension of any topic we must begin with the present experience level of the individual student. If the concepts to be developed are to become a part of his comprehensive understanding they must grow out of concrete experiences. Word meanings are clear only when the individual knows what they signify. We have experiences which are the basis of perception. We perceive, we analyze, we eliminate, we organize, we add, we integrate and so develop an understanding or increase our comprehension of the unit or topic.

Thinking

The solution of problems by thinking is called, by many, the sublime psychological function. The problem guides the thinking of the individual while he draws upon his observations, imagination, memory, and knowledge. Out of these he formulates a solution or develops for himself some new knowledge.

The largest share of our problem thinking is done by means of symbols. This further emphasizes the need for adequate symbolic understanding.

We frequently avoid serious thinking by recalling some former thinking or by adopting some other individual's thinking to the solution of a problem.

It is pointed out at this time that knowledge is prerequisite to thinking. Also that knowledge is no guarantee to thinking. We may say that we learn by thinking and think by learning.

Attitudes

We know much more about the development of other psychological functions than we do about attitudes. Attitudes have been variously described but are generally given to mean, a predisposition to act without the advent of consciousness.

It has been found that some factors do affect the attitudes of individuals. Some of these are information, failure, association with people (imitation), home, community, school, and physical defects. This is by no means an exhaustive list and does not indicate the magnitude of its importance.

Transfer of Training

When the results of learning in one situation affect performance in a different situation we say there has been some transfer of training.

To secure the maximum transfer of training, teach for it. Do not allow it to be incidental. Learning and some cases of transfer may come incidentally, but this is not reliable.

Transfer of training occurs through the medium of common elements. The greater the number of common elements found in the original situation and the new situation the greater is the degree of transfer.

Transfer takes place through generalizations developed during training.

The value of any learning is not in the ability of the learner to use it in the form in which it was learned. Rather, it is in

the ability of the individual to adapt the thing learned and retained to new situations.

Transfer is more likely when things are learned in their relationships to larger situations rather than as isolated facts.

I believe it is apparent by now that as there is no royal road to learning, there is no single prescription for teaching success.

We do know that learning depends upon activity on the part of the learner. Also that learning takes place through the response of the learner to internal and external stimuli.

Methods of Presentation

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Transfer of training previously discussed is a problem of method in so far as attainment is concerned. This is especially true when the achievement of the less tangible goals as attitudes and methods of thinking are considered. There is considerable agreement that if transfer values are to be effected, they must be taught directly and not left to chance.

The principal outcome since the beginning of our educational attempts has been the mastery of content. Added to this has come some thinking that we should teach for understanding of principles, generalizations, attitudes, appreciation, etc. These trends are encouraging as they lead to the kind of learning which makes content useful to the student in his chosen area and in living a daily life.

Throughout the years several methods have evolved either by experiment or by trial and error. Most of these methods have been effective in leading to the mastery of content.

Lecture Method

The lecture method of presentation goes back to early times. The times when books and manuscripts were rare and knowledge must of necessity have been passed on from master to pupil by word of mouth. It is the most criticized, yet the most commonly employed method of teaching especially at the college level. It has been described as the transferring of facts from the notes of the teacher to the notebook of the student without going through the minds of either.

Its common use may be attributed to its ease of administration and it's adaptation to large classes.

Some of the criticisms libeled against the lecture are:

1. **There is no thought provoked by the lecturer.**
2. **The student is passive and the teacher is the only active participant. (Learning results from self activity).**
3. **The teacher or lecturer overemphasizes the acquisition of facts.**
4. **There is no student enthusiasm aroused because the lecturer follows his notes too closely and the student must focus his attention on note taking.**
5. **Much time is wasted by the lecturer in giving data that could better be furnished in books or mimeographed.**
6. **There is no opportunity for self expression by the student. He just listens.**
7. **Lectures are commonly ineffective and uninteresting.**
8. **The information imparted by lecture is too easily forgotten.**

It has been said that if the material given in lectures is important print it, if not skip it. This of course, is an exaggeration. Lectures have been used and will continue to be used effectively in the future. If this is true effort should be expended in making the lectures good.

What are some suggestions to be heeded in preparing and presenting a lecture?

I. Attention

Get the learner's attention. This has been previously noted as a factor affecting learning. It was stated at that time that we could get attention through the use of moving objects, changing stimuli, and novel situations. Being different attracts attention. The individual whose actions can always be predicted is not interesting. If the lecturer fails to manifest variety he fails to capture the attention of the class. He may lower his voice unexpectedly. He may vary the length of his sentences. He may shift from description to narration or from narration to exposition. He may desert the abstract and get down to concrete problems. He may even tell an appropriate story.

Another factor in getting attention is the strength of the stimuli presented. We see the headline of the newspaper first because of its size and bold type. A sentence read with emphasis is more effective than one read off ineffectually. The use of words that have meaning in the common experiences of man are of real attention value. The use of direct nouns is more effective than the use of abstract nouns. A vigorous presentation results in a greater depth of impression.

Repetition is another factor found to be advantageous. Some one has stated the three laws of learning as repetition, repetition, and repetition. Repetition is the technique employed by the advertiser and the propagandist. It is the repeated idea that sticks. To be more effective the repetitions should be accompanied by some variation. The more important ideas are repeated several times but in a different phraseology to avoid monotony.

If the lecturer is to be successful he must make the elements of the lecture fit together in a neat little package. The words phrases and sentences must fit together to form a unified concept. Statements including many exceptions and limitations are less effective than direct unmodified statements.

Novel or unique statements are effective attention getters.

These factors of intensity, change, motion, and uniqueness all pertain to the stimuli presented to the class. Together these form only one of the factors tending to govern attention.

II. Interests—Needs

The interests, needs, or mental set of the learner or listener are also important forces to be taken into account. The lecturer, if he is to be most effective, will introduce the facts only after he has prepared the students to receive them. This problem of motivation has also been previously noted. How can this preparation for the reception of facts be accomplished?

The lecturer may begin by talking about something common in the experience of the students and relevant to the problem to be discussed. Everything that is contained in any lecture must be projected against the background of experience and interests of the students. That which is most effective in a lecture will have some common denominator in the backgrounds of the students and satisfy some need or desire.

The lecture may begin with a startling statement, thus hoping to get the attention of the students.

The teacher may make use of some of the dominant human urges in carrying out his lecture. Some of these urges are personal comfort and well being, adventure, curiousity, leadership, personal efficiency, etc.

III. Preparing the Lecture

Included here are a few hints some people have found helpful in preparing lectures.

1. **The lecture is to be carefully planned. What facts, concepts, principles, or generalizations do you wish to present?**

2. Organize the material into its most natural order. Begin with the idea that is found in the background of experience of the students. This may not necessarily be the simplest one first, but sometimes is. After this is found the concepts are to be developed as one is the logical outcome of the other. Do not skip steps in the understanding, make it complete. Sometimes the ideas or concepts are taken up in chronological order. This is particularly true in presenting theories to explain phenomena. Sometimes the ideas are to be presented in order of their importance. Whatever the arrangement, be sure you begin with the students level of experience and not with what you hope is the level of his experience.

3. The main points should be definitely stated. All other statements should point to the main topic sentence. They should contribute to an understanding of the meaning of the topic sentence.

4. Plan everything so as to make progress toward the goal of understanding. Keep the class moving. Do not wander too far off the path. Keep the forest in sight, not the individual trees along the path. When there is a transition from one line of thought to another make it clear. You may say something like, "Let us look at the problem from another side." Be careful not to confuse the listener.

5. Present a clear concise summary. This is not always necessary. If the concepts stand out it is unnecessary. If the concepts are a part of a larger generalization the summary may be helpful.

IV. Retention and Clarity

In order to facilitate retention and clarity of understanding as a result of the lecture there are some simple hints to be considered.

1. Put ideas in the simplest possible form. You may begin with a technical statement but be sure to follow this with something meaningful. Analogies are often helpful to add meaning to technical statements.

2. The blackboard should be used when ever possible. Sketches to show relationships, diagrams of apparatus, listing of points, organization of data, etc. All are helpful. You are making use

of two avenues of learning, listening and seeing. The chances of retention too are increased.

3. The terms used in the lecture are, to be specific and easily understood. Never use general terms when common specific terms are available.

4. Give as many concrete uses of a concept as possible. Remember facts are tools of thinking.

5. Whenever it seems advantageous use pictures, charts, graphs, etc., to supplement the lecture. One picture is worth a thousand words, in many cases.

The opinion has been given that students may be helped to learn how to think through the lecture. This they say, is done if the lecturer raises conflicts and presents problems rather than handing down solutions.

V. The Lecturer

The lecturer himself has a great deal to do with the success or failure of a lecture.

1. The lecturer should know his students.

2. He should be impartial, sincere, not sarcastic, human, patient, and at times informal.

3. He should be enthusiastic about his subject. This enthusiasm should be carried over to the students as a result of his actions and words. I'm not at all sure that an enthusiastic teacher is not the most powerful motivating device we have. It seems that motivation or interest is more often caught than developed.

4. He should enjoy working with the students and reveal this pleasure to them.

5. He should speak at a moderate rate. This is because the students have to take notes. A lecturer should not dictate.

6. He should speak with a clear understandable voice.

7. **He should speak with a conversational, well modulated voice.**

8. **He should use proper English and pronounciation.**

9. **He must not try to show off his exceptional knowledge. Keep the class level in mind and adapt your material to it.**

10. **He should avoid mannerisms that annoy students or divert their attention from the job at hand. Combing the hair with the fingers, straightening the tie, pacing back and forth, balancing on the edge of the table, etc. are a few of these bad habits.**

11. **Keep the students in view and in mind. You may get a cue from them that you are missing the point entirely.**

12. **Use humor appropriately. Don't drag out a story just to have a story.**

It is noted by this time that unless certain precautions are taken the lecture may be in danger of becoming ineffective.

It would be absurd to use the lecture exclusively of all other methods. Use the lecture only when it gives promise of being effective. The purpose of the lecture is not the mere setting forth of large quantities of information. It is to afford a broad interpretive survey of a field of study, giving students some clues for guidance in reading. The lecture is synthesis and not analysis. It also serves well as a motivating device.

The lecture should not take the place of the textbook, rather it should supplement it. The lecture is to be flexible and easily adapted to the listeners. It must not make personal reading and investigation on the part of the student unnecessary.

When the object is to impart a body of content, the lecture is the most economical way. Other times when this seems appropriate are to afford a new interpretation based upon the synthesis of old material, and to afford inspiration to the students.

The lecture method is adapted to the economical instruction of large classes.

Lecture-Demonstration

A modification of the lecture method is developed through the addition of demonstrations to the lectures. Here we find the spoken word supplemented by a series of actions on the part of the teacher. These two forces tend to reinforce the learning by the use of two avenues of approach, the eye and the ear. Problems become concrete when they are connected up with common experience or when contact is made through real objects. Demonstrations or experiments are important as a means of clarifying a students mental imagery.

In the lecture demonstration the flow of information is from the teacher to the students. The teacher shows everything, explaining each point as he performs the work. The demonstration may serve to illustrate a process or procedure or to show what happens. (Used to objectify subject matter).

Many times the lecturer uses depictive materials as pictures, charts, graphs, motion pictures, etc., to supplement both the lecture and the demonstration.

Discussion-Demonstration

Another method commonly employed in secondary schools and not so commonly in colleges is the discussion-demonstration technique. In this method the demonstrations serve the purpose of provoking discussion and creating a problem situation, or they are to clear up some point concerning which there has been a discussion and to clinch the matter in the mind of the student.

The student becomes an active participant in the learning process. Some teachers have developed demonstrations in which all the teacher does is to manipulate equipment. He says little or nothing. The students do the observing and telling. This gives the student some reason for being in the classroom.

Still another modification of this is to provide each student with a directed observation sheet. As the demonstration is per-

formed the students tabulate data and note relationships. Later they are helped to summarize the data, state relationships observed, and draw conclusions.

Demonstrations are teaching aids and as such should be used only when they can function. A demonstration should not be given for entertainment. If it can be useful in showing some procedure or aiding the students in developing understandings then it should be used.

Demonstrations used in this way make the learner active, directs his attention, develops powers of observation, aids in developing understanding of principles and aids students in distinguishing between true causal relations and mere antecedence.

Demonstrating Skills

In demonstrating a skill to be learned the teacher must take care that the student is in a position to observe the essential details of the demonstration and that his attention is devoted to it. It must not be hurried, but should be given slowly enough for each step to be seen and understood. When there are several steps involved in the demonstration it may be necessary to repeat it several times. A mistake commonly found in demonstrating a skill is to give too much at one time.

The capacity of the learner is limited with respect to the number of steps that can be incorporated into a single task. A complex process must be taken up a few steps at a time. As these steps are mastered more may be added. A demonstration of a motor skill may be confusing if the student faces the teacher. The reason for this is that the learner in such a position sees the movements reversed.

Objectifying Concepts Through Demonstrations

In demonstrating a principle or developing a concept through the use of demonstrations there are certain rules to be followed.

1. **The demonstration must work. Every time the teacher has to say, "This is what should have happened," the confidence of the students is decreased. The teacher should have the apparatus set up and should carry the experiment through to completion before he tries it on the class. After this is done and it still doesn't work before the class, he may then have the opportunity to use the problem solving approach to determine the cause of failure. The experiment must be as nearly infallible as possible.**

2. **All materials to be used in the demonstration should be carefully arranged on the demonstration table before the class arrives. Students do not like to see the teacher fumbling around for equipment which should have been there. If the experiment calls for specific quantities of chemicals it is advisable to have these all measured out in advance.**

3. **The apparatus should be large enough so that all the students can see it clearly. The demonstration is set up for the benefit of the students not the teacher. If the teacher has to describe everything that happens he could probably do as well without it.**

4. **Demonstration experiments should be simple. Students become impatient if they have to wait through a long drawn out experiment with complicated equipment.**

5. **If there is an element of surprise in the experiment it may help to increase interest in the demonstration. It is doubtful if a demonstration should be given just because of the element of surprise and is of no teaching value.**

6. **Use the blackboard, if necessary, to supplement what the students cannot see.**

7. **The students should know the purpose of the demonstration. It is not good practice to say that the demonstration is to prove something, rather state a problem with the students and have the demonstration serve as a part of the solution.**

8. **If strange equipment is used it should be named. To call any piece of apparatus a gadget is out of place.**

Advantages and Disadvantages of Demonstration

What are the advantages of the demonstration method of teaching?

1. **It is a time saver for both student and teacher.**

2. **It is the least expensive method of getting contact with objective material.**

3. **All the students observe the same techniques and procedures.**

4. **It is said to be more efficient since the teacher is supposed to be a trained manipulator.**

It has many disadvantages also, as:

1. **Deprives the student of the advantages of handling materials and equipment and sometimes the formulating of his own generalization.**

2. **It assumes that all students see and hear equally well.**

3. **The teacher may exclude the student from the activity.**

In general the demonstration method when combined with a well directed discussion is a rather successful teaching technique.

Laboratory Method

This method is not so easily definable as some of the others. It is usually given to mean that each student or pair of students is provided with specimens, materials, equipment and a work guide for performing some task. It provides for direct contact with materials and apparatus.

The experimental work should aim to bring clearly before the student the meaning of laws and processes, and should enable him to organize and apply such knowledge. Instead of verifying or rediscovering a law the student should perform an experiment to help him see how it was formulated and what it means. As teaching methods advance doubtless more time will be given to laboratory work with less to formal recitation and lecture. The laboratory will eventually become a place where the student asks questions and finds answers under the guidance of the teacher. The classwork will then consist of:

1. **Organizing the knowledge obtained in the laboratory.**
2. **Showing the wider meanings and applications of the knowledge.**
3. **Laying the foundation for more laboratory work.**

The laboratory work is only a part of any total course. Properly used it will prove to be a powerful learning aid.

The laboratory work should be more closely correlated with the other classwork. The classwork should lead up to and prepare for work in the laboratory as well as follow it. One should supplement the other. All too often the laboratory work is one course and the lecture is another. This is wasteful and ineffectual as a learning device. Students are given a cookbook guide and ordered into a laboratory. As often as not, they do not know the purpose of the laboratory exercise. The results they obtain have little or no meaning to them. The result is that the slower student copies from the brighter and the brighter has the answer before he enters the laboratory.

Instructions should aid the student in setting up apparatus but they should not tell him the answer. They should help him to make accurate observations, see relationships, and formulate generalizations. The laboratory should also help the student develop some desirable skills. The laboratory should be a place where the student is an active learner under the guidance of the teacher. The laboratory is a place where a skilled teacher is needed. This is the place where the teacher and student come into direct contact. This is the place where individual student difficulties may be overcome.

The laboratory is not the place to repeat that which is learned in another part of the course. Students spend untold hours writing up details of an experiment and making detailed drawings (many copied from other books). Dispensing with writing up experiments is not advocated, however, let us make the write up a learning experience. Sketches have been shown to be as valuable as detailed drawings. Data are to be gathered and summarized. Relationships are to be noted and generalizations formulated.

Maybe the student comes out with the wrong answer in the laboratory. What happens? He gets a 3 rather than a 10 on that exercise. The laboratory is not serving as a learning experience, it is rather serving as a means of evaluation. Expert scientists do not always get the right answer the first time, yet we expect this kind of perfection from the inexperienced student.

The laboratory method of learning or teaching, as you will have it, is costly. It is probably the most costly of all instructional procedures. Properly used it is probably the most effective learning device known. We should take care to make it function so that it will earn its way.

Advantages and Disadvantages of the Laboratory Method

What are some of the advantages of the labortory as a method:

1. **It gives an opportunity to learn by doing.**
2. **Student has direct contact with materials.**
3. **Student learns to follow directions.**
4. **If properly organized, the student records observations and results, summarizes data and draws conclusions.**
5. **If properly organized, the student learns to handle material and does much thinking for himself.**

It also has some objectional features as:

1. **Costly.**
2. **Difficult to schedule, if double periods are provided.**
3. **There is no guarantee that a student will learn to think more carefully in the laboratory than in any other place.**
4. **The students are unskilled so it is more wasteful of time.**

Textbook-Recitation Method

The textbook is commonly a compendium of information. It has been used and abused.

Some teachers give an assignment in the text and later hear the lesson. To be able to answer questions based on reading is commendable but one must be especially careful not to mistake verbalism for understanding. Some of the present quiz sections are little more than recitation periods. This practice of having quiz sections has also been abused badly. Usually a graduate assistant is in charge and he has neither interest nor skill in helping people learn. These sections should be in the hands of a skilled teacher. This is a time when the teacher can determine some of the learning difficulties of the students and do something about it.

The textbook has its values as well as its weaknesses. A text used to supplement the lectures, laboratory work, and demonstrations is almost indispensible. It is an important learning aid. Certain types of information such as descriptions of process, conditions, and inventions, and factual knowledge concerning economics can best be learned through careful reading. It should be followed with subsequent organization into a form that can be summarized by the student. Much of the cultural side of science may come through reading.

Another use for the text is as a reference. A place where the student may go for help.

Added to these methods are those employing field trips and museum trips. Some of the methods of later development are known of as the problem method and development method.

Summary

There is no one method that can be given as a specific in any area. The method must be chosen in light of outcomes to be achieved. Whatever method is chosen must lead the student to become a seeker and an inquirer. The student must be able to an-

alyze, and synthesize. He must see analogies, causal relations and unusual happenings. He must learn to abstract in order to determine what may be applied usefully. If all this exists then abilities will be developed and training will result.

Some Suggestions on Teaching Fundamental Mathematical Concepts

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There is no area in which there is at present greater activity and concentrated effort directed to a study of teaching problems than in mathematics education. Evidence of this comes from the rapidly increasing membership of the National Council of Teachers of Mathematics; the rather numerous summer conferences and institutes; and the studies and reports of special committees and commissions such as the report of the Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics; the Commission on Post-war Plans; volume IV of Science and Public Policy, the so-called Steelman Report. The section of vol. IV on Teaching Science and Mathematics was prepared by the AAAS Co-operative Committee on Teaching Science and Mathematics. This great interest and activity is of course due to widespread recognition that all has not been well with the teaching of mathematics and to the faith of many that the problems are not without hope of solution.

Thesis 2, of a list of 34 theses put forward by the Commission on Post-War Plans is "We must discard once and for all the conception of arithmetic as a mere tool subject." Acceptance of this thesis would be little debated at a meeting of mathematics teachers. For this seminar it seems to me that is exactly the phase, namely

"Arithmetic as a tool" with which you are concerned. Though the point of view of this seminar is thus somewhat different from that of mathematics teachers my hope is to be able to make some contribution by reviewing quite briefly a number of current practices on teaching elementary mathematical concepts; by touching upon classroom procedures as drill and testing; and by giving special attention to a few of the concepts which appear to be important in your use of arithmetic as a tool. I wish that I were able to face your problems more specifically and to use more direct applications from your field. But I hasten to assure you it is my conviction that the most important factor in teaching is knowledge of the subject, and I do not presume for a second that a specialist in mathematics education has any business talking to you about how to teach your own special applications unless he has had training as a pharmacist and probably also experiences as a pharmacist. In any case what I say is important, in a seminar of this type, only in terms of discussion that it may stimulate on your part as teachers of the arithmetic of pharmacy. In this brief review of points of view on teaching basic concepts, I trust that at least you may find some basis for hoping that the products which come to you will not be so hopeless mathematically.

Within the past ten years there has been almost universal acceptance in mathematics education of the meaning theory of instruction. The term is used in contrast with a drill theory in which repetition is accepted as the important factor in successful learning; and the incidental learning theory, endorsed by the progressives in the thirties, in which it is accepted that basic mathematical concepts can be learned incidentally while the student is running a play store, playing a number game, or trying to analyze a Gallup poll.

"The meaning theory" has never been carefully defined but its implications are reasonably clear. Under the meaning theory there is emphasis on concepts rather than skills, there is a particular objection to use of rules especially before the rules have been rationalized. Particularly on the most elementary levels there is acceptance of a sort of experience procedure in which, for example, the child instead of being told to invert the divisor and

multiply for a division of fractions might be led to a discovery that the problem could be solved by such a procedure. One recognizes immediately that the experience method is time consuming. Under the meaning theory, the mathematical aspect as well as the social aspect is recognized as a special objective of teaching. It is considered of value in itself to know the nature of place value, the forms of fractions, and to understand the various operation in addition to knowing how to use them in a specific situation. It is recognized that mathematical competence demands understanding of the *"meaning of"* as well as the *"meaning for."* Under the meaning theory there is emphasis on the reasonableness of results and the importance of generalizations, two aspects to which special attention will be given in this paper.

A second hopeful present emphasis is the recognition that the learning of mathematics is a continuous growth from earliest number experiences to graduation. A successful teacher in any one grade must know what the number experiences of the previous year have been and what the number experiences of the future will be. The teacher of algebra must make use of the arithmetic of the earlier years and must at the same time anticipate the calculus.

In curriculum organization there are widespread attempts to foster the teaching of general mathematics rather than separate area subjects such as algebra, trigonometry, and geometry. The Commission on Post-War Plans is as much responsible for this as any agency. This Commission listed 28 essentials for fundamental competence in mathematics. Now that these essentials have been specifically listed there may be notable improvement in minimum essentials in the near future. Among these essentials for the student are:

"Has he fixed the habit of estimating an answer before he does the computation and of verifying it afterward?"

"Does he have a clear understanding of ratio?"

"Does he know the meaning of a measurement, of a standard unit, of the largest possible error, of the statement 'a measurement is always an approximation'?"

"Does he know how to use the most important metric units?" While in many high schools general mathematics is planned for slower students (a major responsibility now accepted by all secondary school mathematics teachers) there is some tendency, particulary at the first year college level, to offer general mathematics for the gifted as well as for the general group. My own prediction is that the mathematics of ten years hence will be more general with the sharp lines between geometry and algebra much less distinct. The student studying similar triangles should acquire understandings that will be of real value to him in solving problems involving proportion in pharmacy.

Two teaching problems worthy of brief mention suggest themselves at this point. These problems are associated with ability grouping and of transfer of training. There is an increasing tendency to recognize that the schools have a dual responsibility in mathematics and science—that of general education and that of special training for the gifted. It is my own feeling that at most any level ability grouping in mathematics can be supported. While in your own area of application ability grouping may be less desirable, the advantages and disadvantages of ability grouping in the calculations course might be profitably discussed.

Furthermore, successful use of mathematics as a tool will necessarily be based on proper concepts and if they are lacking something will have to done about it. Especially if your students are found deficient in basic concepts some ability grouping in sections or within the class may be almost necessary. No-credit remedial sections, as in engineering, may be desirable and most university departments of mathematics would be willing to assist in such work. It is essential that such remedial sections be devoted to understanding of concepts rather than mere drill on skills.

While modern psychology has caused us to give up the idea of mathematics as mental discipline, all psychologists recognize that there can be transfer among like elements and that if there is to be transfer that one must teach for it. This was my point of view in expressing the hope that study of similar triangles would

mean increased ability to understand the basic ideas of ratio and proportion with resultant skill in applying these ideas. The acceptance of the possibility of transfer at least in very like situations seems essential to me in the teaching of basic concepts in terms of their direct applications. Indeed the principal proposal that I wish to make in this discussion is closely associated with this notion. Acceptance of this principle is important in making full use of the meaning theory of instruction. If an attempt in all situations is made to find like elements with resulting emphasis or generalization and de-emphasis on itemization, many major difficulties would be erased. The teacher of the arithmetic of pharmacy does not consider the problem of: "Make 48.6 per cent alcohol, by volume, from 94 per cent alcohol, by volume" essentially different from the problem: "How many ounces of 12 and 18 per cent powdered opiums are required to make 24 ounces of 14 per cent opium?" Certainly an ability to solve the first should contribute to the understanding of a procedure for solving the second. The idea of generalization lies at the heart of mathematics and is one of the moving spirits of modern mathematics.

Mathematics supplies the language for the treatment of quantitative problems particularly in science. This language makes possible the discovery and description of basic relationships from the most elementary to the most advanced levels. Mathematics also supplies science with numerous methods, provides a means of prediction and of deducing conclusions, but it is particularly as a language that mathematics makes its contribution in the more elementary area. Mathematics as a language provides a ready means of generalization.

In algebra symbols are introduced to represent quantities and operations. While one frequently recognizes algebra as a means of avoiding thinking, it is actually a means of avoiding thinking about details and specifics and a means of thinking in general terms—witness the simple application of the area formula in geometry or the Fahrenheit-Centigrade formula in science. By means of the symbolic language of algebra variations can be analyzed and relations among quantities studied. The use of symbols as against the older arithmetic procedures in solution of

the mixture problem common in pharmacy, will make an excellent illustration of this idea.

Before considering such illustrations, I would like to make brief reference to a number of teaching suggestions which should be about as suitable for teaching applied arithmetic as for teaching the basic concepts themselves.

I can think of no other area of application where vocabulary is of such great importance as it is in your area of interest. Certainly no attempt should be made to teach students, the arithmetic of pharmacy in which unfamiliar terms are used. Either the arithmetic should be postponed or adequate time must be allowed to make the terms familiar by some at least limited experience. In the introduction of any new procedure or idea, make certain that the students know the terms and relations to be used or provide them some means of making themselves familiar with them.

While in a professional course problems of motivation are less difficult, adequate provision for learning should not be overlooked. My experience in teaching engineering students and students of agriculture has been that they often think the applications chosen are of no real value to them and I had frequent occasion to agree. Problems of teaching the mathematics of pharmacy should be real to the student in their practice of pharmacy and in their study of pharmacy.

Short cuts certainly have their place in any tool applications and may be important. According to accepted psychology of teaching mathematics short-cuts should not be introduced unless they can be rationalized by mathematical procedures. An easy illustration of rationalization can be had from the example of two-digit numbers ending in five. For example the square of 35 is 1225; the square of 75 is 5625. These special cases are easily verified if one thinks of the square of 10a plus 5. Or another more general expression of this is the product of two numbers with the same tens digit and in which the sum of the units digits is 10. You might find interest in devising a slightly different kind of general-

ization for a product like 45x55. Short cuts are merely special cases of some frequently easily generalized principle.

This point also brings to mind the old algorithm for extraction of square root which some teachers like to teach in the eighth grade rather than a method which would give meaning not only to that process but to other important understanding of the number system itself and of interpolation.

Probably in no area of application is there greater need for accuracy than in pharmacy, even including engineering and bridge building. It is extremely important that you demand accuracy in solutions especially on tests, but also in all drill work. The habit of recognition of the reasonableness of the result will contribute much to accuracy. The requirement that the student think of a reasonable result before computation may save lives. Such preliminary estimates not only lead to accuracy but also often suggest a method of procedure. This seems to me particularly useful in conversion problems. The student recognizing that the centimeter is a smaller unit than an inch, will not divide when he should multiply to find out how many centimeters in a foot and a half. Preliminary estimates of answers should help in your problems in finding per cent by weight when per cent by volume is given.

Something should be said about the place of drill in teaching arithmetic concepts. While we have in education gone in the past fifty years the whole way from saying drill is all important to saying that it is of only negative value, 1949 style is to have no fear of saying we do believe in drill in arithmetic—that is drill of the right kind. We do not attempt any longer to list how many repetitions of the combination 6 plus 7 are necessary to learn it; nor to list 53 unit skills in addition of fractions for purposes of drill, nor to enumerate how many higher-decade combinations are needed for carrying in multiplication.

We do, however, have faith in the possibilities of teaching such personal charcteristics as the love of learning, scientific attitude, and critical judgment and we believe that repetition will

contribute to these learning goals. Modern psychology recognizes that there is learning from drill, even of the intangibles.

If there is to be efficient learning from drill, drill must be preceded by understanding. Any of us could learn without too much effort how to multiply a three digit number by a three-digit number without writing down the partial products in the traditional manner. The difficulty of this learning and the amount of necessary drill is greatly lessened if it is first observed just why any particular short-cut would work.

Drill must be specific. For successful learning by drill some specific concept or understanding must be the center of attention, but at the same time the drill should not be merely meaningless repetition of a specific fact or process. The specific type of application should be varied and stated in various manners. Drill should be short. Probably 30 minutes is of sufficient length for drill on elementary arithmetic concepts, even for adults. If more time for fixation seems necessary then these shorter drill periods should be spaced to provide it. It must be kept in mind that there can be drill on principles even though drill is specific. To be specific does not mean to be limited to a detail of fact or computation.

It is of extreme importance that drill be accurate. Nothing is worse than drill which allows repetition of errors. Provision for accuracy is not always easy. Adequate supervision particulary in the early stages of the drill, may be possible only in small classes. Answers certainly can safely be provided at the college level. Continued emphasis on recognition of the reasonableness of the result will as has been noted contribute to accuracy. Provision for individual differences, essential in itself, will also make for greater accuracy in that the slower students won't cover material haphazardly in order to keep up with the group.

Reference has already been made to proper spacing of the drill. In addition to the desirability of spacing drill periods spacing is necessary for cumulative learning and maintenance of concepts and skills previously learned. While frequent short tests may be of considerable advantage in classes such a testing porgram needs also to include provision for test over larger units

of work and tests which will require both review and recongnition of similarities and organization of material and ideas. Review is often considered a part of drill but review involves more than mere recall and repetition. Review should impose the necessity for organization and association on the part of the student in addition to any review materials provided by the teacher.

It is so easy in teaching mathematics at any level to fall into a set pattern of class procedure that a word of warning here in connection with drill might be appropriate. A variation in order of class activities and of the activities themselves including drill and testing should be followed. Such varitation not only adds to interest but should assist in preventing too stereotyped approaches to problem solving on the part of the students.

While special attention to evaluation and testing procedures will be given by an expert in such matters in the program tomorrow, I would like to make brief reference to a type of test which appears particularly appropriate for the kind of course that I understand the arithmetic of pharmacy to be. It is a test made of problem situations as real as they possibly can be. Such tests can be so organized to point up the similarities and general principles and to focus attention upon the nature of key problem situations, and to measure understanding. The kind of understanding desired in a tool course is the ability to use the tool in a problem situation similar to those with which the student should be familiar. An occasional question in which the student is asked to explain a procedure or relationships would be helpful. I cannot see that multiple choice questions would be very suitable for such a course. While the frequent short test may have value in making sure that the students work at regular intervals, it should be of little value in measuring the effectiveness of learning.

At this point I would like to try to illustrate some of the more general suggestions that have been made with reference to some very elementary concepts which appear to be useful to the pharmacist in his practice. Probably the most elementary of these is that of a fraction itself. As the term fraction is used it is intended to include common and decimals fractions and per cents since they are all symbolic representations of the same concept. Too many

students have come from the elementary schools without recognizing the common meaning of the various fractional forms.

The extension of the number system to fractions was not an easy concept for the human race and the difficulties of the students of our day with this convenient tool of man is merely a reflection of the struggle of the human race to devise the present highly usable fraction symbols. The Egyptians of four thousand years ago confined their fractional forms to so-called unit fractions, with the exception of $\frac{2}{3}$. Babylonians used some sexagesimal fractions, that is fractions of denominator 60, from which our system of measurement of angles has come. In Euclid's Elements the only treatment of fractions is in connection with proportion and an application in the theory of music. Latin influence in the development of the fraction concept is still seen in our system of measures. Actually it was 1,000 years after the first use of decimal system of notation that Simon Stevin made the first systematic treatment of decimal fractions. Even today there is less universality in our manner of writing the decimal point than there is in most of the rest of our mathematical notations.

If it is once recognized that the denominator is merely the quantity named and that the numerator is the number of the quantities named, the fundamental processes with fractions become merely the fundamental processes with denominate numbers. Adding 4 fifths and 3 fifths is the same as adding 4 books and 5 books; or adding 4 fifths and 5 sixths is like adding 14 inches and 2 feet. A common measure must be found before the numbers of the quantities can be added or subtracted. Furthermore whether we are dealing with fractions or denominate numbers the basic mathematical concepts are not different from those involved in the integers themselves. The number 247 is 2 hundreds 4 tens and 7 units. Common denominators and reductions are involved in the processes with the integers as well. The new arithmetic strives to make these concepts crystal clear. The discovery and emphasis on relationships illustrated by the simple examples and the tying up of the new ideal with the old are means of taking fullest advantages of opportunities for transfer. These are major suggestion that I have for teaching basic mathematical concepts at any level, and for themselves or as a tool.

This kind of analysis can be carried even farther with fractions. All of us are familiar with the so-called three cases in per cents. Too seldom does the arithmetic teacher point out that the same three cases exist in all fractional problems. Sometimes the problems involving fractional increase or decrease are included as separate cases although they are easily reduced to one of the basic cases. In some circles it is considered profane to refer to even the three cases as cases since they all are a part of the same type of relationship and should not be considered as separate. Furthermore the relationship is merely that of the product of two quantities equal to a third; the same relationship as that between the area of a rectangle and its sides.

I strongly recommend that the percentage formula be used for integration of thinking in percentage. This formula

$$br=p$$

is the key concept in all applications of percentage. Students with the maturity of college freshmen would be exceedingly foolish to think in terms of "cases" of percentage when all relationships can be simply expressed. Proper use of the formula will mean the reduction of the three cases to merely different aspects of the same problem. Substitution in the formula followed by solution for the unknown not only simplifies the computation but gives added emphasis to the fundamentally simple relations involved in all problems with fractions, and affords a ready means for appropriate study of variations.

In this brief discussion it has been my intention to emphasize the idea that common fractions, decimals and percents are merely different representations of the same concept. Naturally some special difficulties with each of the symbolic forms must be recognized. Probably the major one of these difficulties is that involving location of the decimal points. This difficulty has arisen because arithmetic teachers at all levels have emphasized rules without any attempt to rationalize them. Computation with decimals should be approached from a meaningful point of view which would enable one to see the reasonable result without any recourse to rules.

The greatest difficulty arises in division. Division by a fraction can best be approached through the measurement concept of division. That is 7 divided by ¼ means how many fourths in 7? 7 divided by .1 means how many tenths in 7. If this principle is carried to a more difficult example such as 2.34 divided by .71 the position of the decimal point in the quotient can quickly be determined by some such an analysis as how many 71 hundredths are contained in 234 hundredths. For multiplication the analysis in terms of the multiplier as an integer as a first step followed by the changes resulting in going from the integral multiplier to the fractional one is a satisfactory procedure. The rules for location of the decimal point in these processes may be time-savers for the moment but for real functional competence and reliable accuracy some understanding of the why of the result is nearly essential. Drill exercises on location of decimal point without recourse to traditional rules would be worthwhile even in a university class.

Currently in arithmetic there is some tendency to increase the emphasis on the use of decimal fractions. Arithmetic would be greatly simplified by a reduction in the variety of our notations to express similar ideas. Such a reduction could be wisely made by a reduction in the use of common fractions.

A word should be put in here also for teaching correct methods of approximate computation—a topic much too neglected in our mathematics classes. It is my hope that you are abiding by reasonable rules for use of approximate numbers and that your interest in greater accuracy does not cause you to fail to guide your students away from needless computations with superficial accuracy in an extended number of decimal places.

In looking over a text on the arithmetic of pharmacy no part of the materials fascinated me more than the sections on percentage solutions, concentration and dilution, and alligation. This fascination came from the similarity of the concepts in all of the sections, from the pertinent applications that these problems are of a basic concept we try to teach in elementary algebra, and from the beautiful opportunity this material affords one to apply the language of

algebra in a generalization of a simple arithmetic relationship. The term alligation is of itself of interest. Our grandfathers studied not four fundamental processes of arithmetic, but rather at least seven, one of which was called alligation. The problems which could be solved by this process are usually not now included in arithmetic. They often are included in algebra but usually in such unreal problems that a sensible students finds little interest in them.

There should be some value in considering a general form that might cover most problems under these heading and to apply it in a few special cases. While the proper procedure in teaching would be to first consider some of the simpler special cases, until the basic idea is clear, let us for each of them examine the problem from the beginning in terms of a general formula:

$$\Sigma a_i x_i = AX \qquad \text{where} \qquad X = \Sigma x_i$$

in which the a_i represents the quality factor, the x_i the quantity factor. The formula above is merely the basic relationship of the weighted mean in modern statistics. Our grandfathers called the problem of finding A where the other terms of the equation were known, alligation medial. The modern statistician merely calls it finding the weighted mean. In algebra problems of this type would be called mixture problems. In a text examined, under the section on alligation alone, one can count no fewer than 10 headings each with its separate group of problems and its special procedure for solution. If arithmetic rather than algebraic methods are preferred the various cases may be considered separately, and with a special effort to point out that each is related to the others and frequent cross references, satisfactory results may be obtained. From the point of view of teaching fundamental mathematical concepts and their applications with the equation or formula method appears to be simpler, and more interesting.

Let us consider a few simple examples.

Take 48.6 per cent alcohol, by volume, from 94 per cent alcohol by volume.

Dilute 240 grams of 92 per cent sulfuric acid to 12 per cent acid.

In what proportion must 12 per cent and 17 per cent extracts be mixed to produce a 14 per cent extract?

How many ounces of 12 and 18 per cent powdered opiums are required to make 24 ounces of 14 per cent opium?

In what proportions must 8, 16, and 18 per cent opiums be mixed to produce a 14 per cent mixture?

The examples are all taken from "Arithmetic of Pharmacy" by Stocking and Cataline. Applications in which the quality factor is specific gravity, cost of materials, or other measures of value could be used as well. In each case the solution can be found by direct substitution in the general formula above.

Though your own experience may convince you that the arithmetic method requiring thinking in terms of specifics is still the most desirable for teaching to the prospective pharmacists, this analysis of the similarity of the situations should be suggestive and certainly should be useful in rationalization of short-cut devices.

In closing it might be helpful to summarize by listing again some of the specific suggestions on teaching fundamental concepts. If these are not in agreement with your time-tested practices and some disagreements result, the time we have spent together probably will not have been in vain.

In teaching basic mathematical concepts it has been suggested that:

1. No one be permitted to teach who is not soundly based in subject matter, not only with the tool but with the materials to which the tool is applied.

2. The "meaning of" as well as the "meaning for" be emphasized; and that necessary remedial work be remedial work in meaning instead of skills.

3. The continuity of the growth of mathematical concepts be always maintained.

4. Plans for ability grouping at least within the class be formulated.

5. The habit of seeking similarities be cultivated at every opportunity.

6. The student at all times be first familiar with the vocabulary and scientific concepts to which the tool is to be applied.

7. Special motivation be provided for each new phase of the work.

8. Classroom procedures be varied.

9. All short-cuts be rationalized, if possible by students themselves.

10. The reasonableness of a result be a test applied to every solution preferably before as well as after computation.

11. Drill be short, specific, well-motivated, accurate, graded to individual needs and difficulties, spaced for adequate maintenance.

12. Test problems be real and that they focus attention on relationships; that a few items testing understanding be included; that the test be looked upon as a learning experience.

13. The units of work be as much united and integrated as possible and that students be assisted at every point in reasonable generalizations, even through the use of symbols to avoid thinking.

Minimum Essentials in Mathematics List

Prepared by

The Committee on Post- War Plans

The National Council of Teachers of Mathematics

The essentials for functional competence in mathematics are put as questions in the following Check List:

1. Can the pupil operate effectively with whole numbers, common fractions, decimals, and per cents?

2. Has he fixed the habit of estimating an answer before he does the computation and of verifying the answer afterwards?

3. Is he skillful in the use of tables (including simple interpolation) as, for example: interest tables, tables of roots and powers, trigonometric functions, income tax tables, etc.?

5. Does he know how to use rounded numbers?

6. Can he find the square root of a number by table or by division?

7. Does he know the main guides that one should follow in collecting and interpreting data; can he use averages (mean, median, mode); can he make and interpret a graph (bar, line, circle, the graph of a formula, and of a linear equation)?

8. Does he have adequate ideas of point, line, angle, parallel lines, perpendicular lines, triangle (right, scalene, isosceles, and equilateral), paralellogram (including square and rectangle), trapezoid, circle, regular polygon, prism, cylinder, cone, and sphere?

9. Can he estimate, read, and construct an angle?

10. Can he use the Pythagorean relationship in a right triangle?

11. Can he with a ruler and compasses construct a circle, a square, and a rectangle, transfer a line segment and an angle, bisect a line segment and an angle, copy a triangle, divide a line segment into more than two equal parts, draw a tangent to a circle, and draw a geometric figure to a scale?

12. Does he know the meaning of a measurement, of a standard unit, of the largest possible error, of tolerance, and of the statement "a measurement is an approximation"?

13. Can he use certain measuring devices, such as an ordinary ruler, other rulers (graduated to thirty-seconds, to tenths of an inch, and to millimeters), compasses, protractor, graph paper, tape, calipers, micrometer?

14. Can he make a scale drawing and use a map intelligently—know the various forms employed in showing what scale is used—and is he able to find the distance between two points?

15. Does he understand the meaning of vector, and can he find the resultant of two forces?

16. Does he know how to use the most important metric units (meter, centimeter, millimeter, kilometer, gram, kilogram)?

17. In measuring length, area, volume, weight, time, temperature, angle, and speed, can he convert from one commonly used standard unit to another widely used standard unit; e.g., does he know the relation between yard and foot, inch and centimeter, etc.?

18. Can he use letters to represent numbers; and does he understand the smybols in algebra, does he know the meaning of exponent and coefficient?

19. Does he know the meaning of a formula—can he, for example, write an arithmetic rule as a formula, and can he substitute given values in order to find the value for a required unknown?

20. Does he understand signed numbers, and can he use them?

21. Does he understand what he is doing when he uses the axioms to change the form of a formula or when he finds the value of an unknown in a simple equation?

22. Does he know by memory certain widely used formulas relating to areas, volumes, and interest, and to distance, rate, and time?

23. Does he understand the meaning of similar triangles, and does he know how to use the fact that in similar triangles the ratios of corresponding sides are equal?

24. Can he, by means of a scale drawing, develop the meaning of tangent, sine, and cosine, and can he use a three- or four-place table of these ratios to solve a right triangle?

25. Can he solve simple verbal problems (in arithmetic, algebra, geometry, and trigonometry)?

26. Does he have the information useful in personal affairs, home, and community; e.g., planned spending, the argument for thrift, unde-

standing necessary dealings with a bank, and keeping an expense account.

27. Is he mathematically conditioned for satisfactory adjustment to a first job in business; e.g., has he a start in understanding the keeping of a simple account, making change, and the arithmetic that illustrates the most common problems of communications, travel, and transportation?

28. Does he have a basis for dealing with intelligence with the main problems of the consumer; e.g., the cost of borrowing money, insurance to secure adequate protection against the numerous hazards of life, the wise management of money, and buying with a given income so as to get good values as regards both quantity and quality?

Techniques and Educational Principles

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Teaching is what the teacher does. The teacher is the presenter of stimuli. The stimuli presented are to be creative of the situation he desires. The stimuli are generally of three sorts: Objective materials, depictive materials, and symbols. Each type has its place. Which the teacher shall use is determined by consideration of effectiveness and economy. The effectiveness depends primarily on the teacher's objective. If he wishes to develop the ability among students to manage real things or to appreciate them, he is wise to use objective materials.

The depictive material can serve appropriately in substitution for the real thing in the degree that it is objective in character. It can serve for the idea behind a thing in the degree that it symbolizes the idea.

Symbols, as words or signs, are used if the teacher wishes to develop the ideas of other men. Symbols or signs can be used

effectively as a substitute for the real thing if the real thing is known to the student.

Remember that teaching is doing. What the teacher believes, desires, knows or thinks teaches no one. A teacher's tools are physical stimuli to the sensory receptors of the learner. The teacher is no magician. He can accomplish his objectives only by putting before his students what they can see, hear, taste, touch and smell and in no other way. The resources of the teacher must be found in what he can do to create situations which will cause the students to react.

The teacher must speak, write, make signs, draw pictures or sketches, place before students books, pictures, charts, models, specimens, implements and other natural things, move things, make gestures, etc., to bring students into contact with the selected stimuli. The stimuli are selected according to his purposes. If he doesn't act in such a fashion, despite his store of academic knowledge, he will have little to no affect in the direction of learning toward his goals.

The media of teaching range from purely objective materials at one end to the purely symbolic at the other. In order for the symbolic media to be of value to the student he must have or have had experiences with the objects themselves.

In the use of the laboratory, field trips or demonstrations the teacher relies largely on objective stimuli.

When real things are not avilable as in the case of an Atomic Pile pictorial materials are used. Many times models, motion pictures, slides, slide films or even sketches on the blackboard are effective. Such depictive materials vary from pictures of the real things to some remote resemblance. Some teachers draw a circle or square on the blackboard and it may represent anything from a distillation apparatus to a molecule. Even these may mean more to a student than a word which has no meaning.

The lecture, reading or class discussion rely almost entirely

on the use of written or oral symbols. Symbols are also necessary in the use of objective materials. The student's actions and observations are guided in the laboratory. His observations are guided during demonstrations.

In some cases the lecturer uses depictive materials to add meaning for the student. To teach effectively with signs and symobls the signs and symbols must have meaning in the experience of the student with the things they signify. The first experience where ever possible, should be concrete rather than vicarious.

The wise teacher uses familiar terms when ever possible. If he must use terms not familiar to the student he makes them known before he relies upon them in his teaching. Confusion reigns when the teacher uses strange terms in describing a thing unknown to the student. He should provide the student with contacts with those things, named as he shall name them, before he asks the student to read about them or listen to him talk about them.

In teaching science, a general principle may be stated to the effect that usually laboratory work should precede lectures, should accompany or precede readings rather than follow especially in the case of new and unfamiliar material.

In spite of their recognized limitations the chief tools of the college teacher are symbols. He does most of his teaching with chalk and chart and talk and text. This has been justified by stating that growth in culture depends upon meaning in symbols.

There are cases when symbols do not stand for objective things, but rather stand for abstract ideas. Learning by reaction to these symbols is direct. This is true in the interpretation of graphic materials. Men may communicate with each other directly through the use of these symbols. This is also true in the study of historic events. Methods are the teacher's main aid.

There are times when the teacher has objective materials available but chooses symbols for economy of time. This may be the

case in discussing densities. After the student has discovered the density of several objects and has an understanding of the topic the objects may be dispensed with and symbols used. College trained people are often characterized as those who can talk well about many things and do well with very few.

The use of real objects is also no royal road to learning. The real thing has no inherent value over the symbol. It is superior or inferior only with respect to the established objectives. Generally speaking it may be said: (1) That to develop skill in the use of a thing such thing must enter into the learning situation. We gain skill in weighing materials by weighing materials. (2) To develop an understanding of a thing outside the students experience that thing must be brought into his experience. The student may know something about preparing Brown mixture but doesn't understand it until he prepares it. (3) To develop an appreciation of a thing not known it must become known.

Sometimes examples are used in teaching. In developing concepts through the use of examples it is important to choose the examples wisely. It is important that the cases chosen genuinely exemplify what is to be learned. They should be carefully chosen so that the student will get all the particulars involved.

This also holds true for the selection of cases to demonstrate a skill. All too often the teacher uses a very simple demonstration and requests the student to perform complex skills. It is better to demonstrate a simple skill to develop the readiness of the student and then go on to demonstrate the more complex skill.

It is acknowledged that the teacher can not present all the cases for any given principle. He must therefore present those cases most representative and those which include the desired skills.

In developing concepts the teacher may use illustrations as analogies. These analogies are usually accessory rather than central in the developing of concepts. Analogies are common in developing an understanding of mixtures. One that often proves helpful is to describe a mixture as marbles and acorns in a con-

tainer. When this is stirred the marbles become mixed with the acorns or the acorns are mixed with the marbles. Another is described as putting salt and sand together in the same container.

Many of the analogies and examples may be supplied by the teacher and many by the students. The abundance of illustrative material depends upon the desired learnings.

Teaching is always selective in accord with purpose. The teacher is more often than not the selector. He must select wisely.

The wider the range of phenomena to which the concept applies the greater must be the number and variety of connections with it, if it is to function usefully. Associations with many species of contexts is a primary means of assuring that the general idea will function in a new situation. If the teacher intends that a concept shall function in a wide range of instances his teaching should involve a wide variety of illustrations. The gradual abdication of the teachers place of prominence is necessary for the successful development of a concept. The teacher is usually the first to supply illustrations of the application of a concept. Through these the student gains a clearer understanding of the concept and he sees illustrations of its application. The student then begins to make applications of the concept. One who has complete comprehension of a concept needs no illustrations from others.

The teacher's place in teaching ranges from active domination of the process to nearly complete passivity. In the first case the teacher tells the student everything. He analyzes situations, picks out essentials and applies them in other situations. The teacher is active and the student is passive. Some say that this is justified as a matter of expediency in teaching large classes. The factors of activity and satisfaction necessary to learning are not at a high potential. The practice is economical administratively but relatively ineffective educationally.

A step in the direction of student participation and activity is noted in the next method. The teacher picks out the principle

in some instances and then calls on the student to find it in other instances. At first the teacher is dominant and later is passive. At first the participation of the student is minor and later becomes important.

This practice is commonly carried out in teaching large college classes. The teacher lectures or gives a demonstration pointing out the desired principles. The student is then given the chance to tell of applications of the principle involved. This practice is economical and more effective.

A third type of teaching commonly found is that of collaboration between the teacher and student. The teacher and students together examine, compare and contrast instances of a concept. The teacher's main job is to guide the analytical activity of the student. The teacher's job is to guide, suggest and assign rather than to tell .

This method is unusally fairly economical and highly effective if the classes are not too large. To be successful it requires the teacher to know the students and careful follow up of work done in the laboratory.

Another method is that in which the teacher cooperates with the students in solving introductory problems but steps out as soon as the students catch on, the students are solely responsible for comparing, contrasting, or applying the principle. This method is highly effective from an educational standpoint. It is fairly economical only in small classes or in sectional grouping of large classes.

The fifth type is that in which the teacher assumes no responsibility in the guidance of the learning process beyond his part in selecting, ordering, presenting, or securing of cases. It is up to the students to get what ever they can from the cases given. The student is the discoverer. This practice is valuable with highly capable students rich in experiences in the field to be studied. The method is time consuming and applicable only to the instruction of individuals.

The teacher cannot do the thinking for the student. The teacher can proceed in a fashion to reduce the necessity for analytical reactions to a minimum. This is done when the teacher tells the student everything. The student may follow this with some interest if he has a strong motive for acquiring meaning from it.

In performing a demonstration the teacher may tell the students the name of some of the apparatus. If the teacher describes the results and his every act the students will soon lose interest. They may be provoked to momentary curiosity if something is puzzling. They will not be provoked to inquiry because they know that soon the teacher will tell them. The students' duty in this is to watch and accept not to seek and find.

If during demonstrations, the teacher serves as a manipulator of equipment and the students tell what is happening and what is being done there is student activity and more likely learning. As a result of the observation of the demonstration the students have data. Cooperative analysis of these data leading to a statement of principle or a conclusion makes the student an observer, an analyzer, a synthesizer and a formulater. He is thinking. He is solving a problem. He has a part in the formulation of a generalization. He has discovered something as a result of his activity. This method also helps to lead the student to see the application of a principle. This method is called the inductive method of teaching.

Added to the demonstration technique is the laboratory. It is generally better for the students to work with the equipment rather than having the teacher be the master manipulater. Through carefully planned laboratory instructions the students may be led to discover. This, of course, does not mean the common cook book type of laboratory directions. The directions should help the student to see relationships, organize data, and draw conclusions. The instructions should never tell them what they will see or what conclusions are to be developed.

Laboratory work should go hand in hand with other tools of teaching. The present practice in laboratory science has been described in a derogatory but truthful way. It is, "The laboratory and other teaching tools are like two trains on parallel tracks each running on a different schedule so they never meet. Rather—they should be two trains on parallel tracks all fastened together by common axles so that they progress together. The progress of one is to facilitate the progress of the other.

The laboratory is a learning aid. It may serve in initial learning or as a drill period. Its use as a dri'l period is very conceivable in the area of pharmacy. The objective of the teacher may be to develop skill in making ointments. This would first be demonstrated by the teacher. The students would then go to the laboratory and make ointments employing the techniques previously demonstrated.

As a result of laboratory activities the student should be able to see relationships. In observing these relationships he should see some form of unity present. The forulation of conclusions terminate with the statement of a principle. This statement should be in the students own words whenever possible.

A common practice employed in college teaching is that of telling a student something in a lecture and following the telling with the statement, "You will see that this is true when you do Exercise X in the laboratory," or "I will show you by demonstration that what I said is correct." A much more effective procedure is to reverse the process. "What did you discover in the laboratory?" "How does this apply in the following situations?" The student should be guided to discover and guided in seeing applications.

The statement of a principle in the students words is sound in all respects. From this he derives a connection between the conceptual meaning of words or symbols and exemplary material. He is thus able to use the words and symbols in the absence of the exemplary instances. He can now use this as a part of his equip-

ment in thinking. If one accepts the doctrine that thinking is sub-vocal activity this is necessary. With a bit of reflection one must come to the conclusion that much of our thinking finds its vehicle in words that flow through the mind. It is also to be noted that the ability to recite a principle is no guarantee of its usefulness. The principle must be understood, it must have meaning.

There is commonly found, in college teaching, a variation from the above described analytical development of concepts. The method combines analysis of the factors to be joined in the principles with synthesis of them by application to complete examples of the principle. This is used when there is a sparsity of examples of the principles or inadequate resources for analytical development. The teacher first develops several of the factors involved in the principle by illustration. Next he attempts to form them into the principle by either real or synthetic application to cases at his command. Sometimes there are plenty of available examples but because of the complexity of the circumstances it would be too slow to develop by complete analysis.

One example of this approach might be in developing the meaning of a prescription. From the book "Pharmaceutical Dispensing" by Husa the following statement has been extracted. "A prescription is an order signed by a licensed physician, dentist, veterinarian or other medical practitioner for medicine to be compounded by a pharmacist to meet the needs of a certain person at a particular time". In order for this statement to be understood or have meaning the student must first know the meaning of "a licensed physician, dentist, veterinarian, or other medical practitioner." The teacher either tells the students or they discuss what is meant by a licensed practitioner. The second in significance will be: ',What is to be compounded?" What drugs? How much of each? How are they to be put together? How are the drugs to be taken? When was this prescribed? Who is the patient? Does it contain narcotics? Who is the doctor? As a result of analysis the reason for each of these questions is given. When they are all synthesized the student knows what is meant by a prescription.

It is observed that little of this is exemplary or demonstrable. The meaning results from analysis and synthesis of other understandings.

College students are often called upon to learn theories that as wholes are not demonstrable or exemplifiable. Here the teacher has to form the conceptual pattern directly rather than by abstraction. If a teacher wants the students to know something about a theory he or someone else has worked out, he has no better recourse than to tell them in a lecture or assign readings. If these lectures or readings are to be successful the student must have a knowledge of the principles brought together. Exposure to words is likely to result in verbalism. To make the most of interest in a presented theory it should be used to explain facts not necessarily understood in terms of isolated principles. The raising of questions or problems to be solved through the use of the theory gives it meaning. Its value comes from its use.

The teacher may expose several theories and ask the students to make a comparison and an application of these facts. The teacher may state a problem and then allow the students to formulate theories on the basis of their present knowledge.

College students have a more than casual speculativte interest in theories, but the value of a theory lies most often in its function. We may say that the exposition of a theory is valuable in the degree that the presentation makes a content of conceptual meanings.

We have previously described some of the factors in developing a skill. Again we return to this important educational outcome. When the student begins to learn a skill he begins with knowing what skill he is to develop. Is he to reproduce the skill or is he only to be concerned with the proper result. In developing a specific skill the student must first form a visual pattern of the act. This pattern may come as a result of observing demonstrations, movies, or in some cases reading or listening. The next step is to develop a kinesthetic pattern. This pattern is formed only by the student under the guidance of the teacher.

In some cases the correct result is all that is important. Here the method is unimportant. The teacher may guide the student to increase the efficiency of the act but the emphasis is always on the result.

The aim in all areas of endeavor is that of mastery of the subject matter. This mastery, as we have seen, can take many forms. One who is master of a subject understands its content as a whole rather than as a mere aggregate of parcels of knowledge. When he meets a problem involving data of the subject he finds a place for it within the conception of the whole. Thus he gains in the ability to reason systematically towards the solution of the problem.

For a brief summary we may say:

1. Know your objectives. What do you want to teach? What concepts do you wish to develop?

2. When the objectives or concepts are analyzed, what learning difficulties are found? What must the student know to begin where I plan to begin? Have I a right to assume that the student has these prerequisities? What is the best sequence of development of the component understandings leading to the understanding of the generalization?

3. How can the objectives be best achieved? What part is to be done in the laboratory? by demonstrations? through discussions? in lecture? In making a selection from and within these methods remember that to be effective as a teaching aid it must lead the student and not drive him.

4. Did I teach what I set out to teach? How am I going to evaluate? What will I do if the results of the evaluation indicate non mastery on the part of some? Who failed, the teacher or the student?

To be effective the teacher must have a daily lesson plan (not necessarily written out) and a unit plan well developed. He must also know how his plans fit into the purpose of the school. The teacher should know his students. The teacher should know the subject matter.

Teaching is a big job. Teaching is a time consuming job. Teaching is an important job. Teaching is helping students to benefit from generations of experience so that he may know that better life.

Audio-Visual Materials and Pharmacy

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I. Before the Word, the Idea

In confronting a mastery of any subject area, whether it be physics, chemistry, medicine or pharmacy, the basic problem of acquainting a group of learners with materials which heretofore have been foreign to their experience and unknown to them is ever with us. For example, let us turn for one moment to the child who finds himself in school on the first day. In the first grade, one of the responsibilities which the teacher assumes is instruction in processes leading to the accomplishment of reading. The reading problem is one of attaching significance to an abstract symbol in terms of experience, or ideas, or things which are described by or relate to that symbol. What opportunity does the child have of successfully accomplishing this relationship unless he is first given a broad background of experiencing with respect to the very ideas, things, and processes which he later is expected to identify in terms of the symbols by which those experiences are represented? The wise teacher of learners at the first grade level makes every provision for objective experiencing. The opportunity to see things for himself, to handle, to manipulate, to investigate, to examine and re-examine is characteristic of good teaching procedure at this level.

As we teachers at the higher education level look at this first grade situation, we are struck by the simplicity of the psychology

thus revealed. Just as these young learners at the age of six stand in awe of a learning problem which involves ideas and experiences which they have never had before, so as we bring to our learning situation students of good intelligence and high interest to contemplate the many subject areas which together make up the field of pharmacy, the nature and degree of difficulty of material has changed markedly, but the basic characteristics of the learning problem remain much the same. For this reason then, we will say that in the field of pharmacy, just as in any area of education, the role of objectivity, of graphic presentation, of vividness, of reality in instruction plays a major part in determining the efficiency with which instruction is followed and with which the learner acquires a well-defined understanding of the new areas of subject content he is invading.

It is with cognizance of this learning challenge that people in the field of pharmacy instruction have devoted so much time to the efficient use of blackboard, charts, laboratory experimental demonstrations, and laboratory techniques. Much of the skill of the pharmacist depends on his ability to use laboratory techniques efficiently, and naturally you have observed the efficiency of actual laboratory experience as a means through which to accomplish this degree of proficiency.

But consider the student who is attempting to become familiar with processes and techniques which may not be readily duplicated in the laboratory situation which applies in the specific instance. Consider his possibilities for effectively mastering manual techniques if he has no opportunity to observe them at firsthand. Consider his inability to grasp the backgrounds of the process in the conversion of native cinchona on the island of Java to refine quinine if this process which goes on thousands of miles from his locale can be presented to him only in terms of verbalism. In his attempt to understand these verbalisms, he finds himself at a loss insofar as his own backgrounds of real experiences are concerned. Consider the possibility of explaining to him a new technique in the manufacture of pills or in the techniques of masking and flavoring when you have nothing but verbal description

through which to reveal these experiences to him. It is at this point that we will contemplate the usefulness of audio-visual techniques of instruction which go beyond that which you can now accomplish in your own laboratory through blackboard techniques, through demonstration techniques, and through laboratory experience.

II. Defining Audio-Visual Materials

Audio-visual materials today include many types, ranging from blackboard illustrations, cleverly conceived posters and demonstration charts, tables of information, slides—both commercially produced and handmade and both of small and large size, filmstrips, transcriptions and recordings, and the 16mm sound film as well as field trip opportunities to visit industry, laboratories, retail establishments, etc.

The question now is logically asked, "By what means do we determine the situations in which we will use the several materials or techniques of instruction?" Growing out of experience in public school education, proponents of audio-visual materials have cautiously warned again and again that a given audio-visual material of instruction should be used only when its characteristics allow for an experience to be efficiently presented. And secondly, as a corollary to this, the given audio-visual material should be used only when it will produce an educational experience in a manner which is above and beyond the means for producing such experience with traditional or currently available materials. This means then that we will use good audio-visual materials of instruction only to create a level of classroom experiencing which is above and beyond that which we now can create through the use of traditional teaching materials in our search to reveal to learners those areas of subject content which are inherent responsibilities of courses that relate to the field of pharmacy.

III. The Several Materials and Equipment Items of Audio-Visual Instruction

Anyone who has long practiced in the field of pharmacy has devised many audio-visual materials and techniques. He has be-

come an able laboratory demonstrater. He has assisted in the creation of display materials and technical demonstrations which in and of themselves are capable of being watched, reacted to, repeated, and observed by learners. There are many problems of instruction, however, which grow out of training in pharmacy which are impossible to be accomplished in the classroom. At this point we must seek further cognizance with sound motion-picture films which bring outstanding techniques of pharmacy into our classrooms, sound motion-picture films which allow us to visit well-organized retail establishments, to visit the laboratories of large manufacturing concerns, or to interview the leading pharmacists or teachers of pharmacy in an attempt to discover their ideas, philosophical or practical.*

The opportunity of bringing the world of pharmacy to any laboratory of the land is entirely within grasp when we think of the many existing sound motion-picture films, filmstrips, slides, or transcriptions which already have been produced.

Our first responsibility, then, is to examine for ourselves all of those existing materials and ask, as we have already indicated, "Can we use these to more efficiently accomplish the learning outcomes which it is our responsibility to attain?" At this point, we should examine several items of audio-visual equipment and see and hear the materials which they are capable of bringing into our pharmacy classrooms.

a. Demonstration situations.

b. 16mm sound films

c. 35mm filmstrips

d. 2" x 2" slides

e. 3¼" x 4" glass slides

f. Sound filmstrips

g. Transcriptions

(Note: At this point typical materials prepared by the **Navy Training Aids Section**, by manufacturers of pharmaceutical supplies, and one "How to Do It" laboratory demonstration film on pill rolling were shown to the assembled group.)

*Adapted from: Ralph W. Tyler, **Constructing Achievement Tests**, Ohio State University Press, 1934, pp. 37-41.

IV. Steps in the Organization of Audio-Visual Materials Correlated to the Teaching of Pharmacy

Perhaps the first responsibility which any group interested in improving instruction meets is a systematic examination of existing audio-visual materials. Today, we have literally hundreds of sound motion-picture films, film-strips, slide sets, transcriptions which directly or indirectly relate to the teaching of various subject-matter areas in pharmacy. If we were to follow the lead of teacher groups in other subjects, committees of interested pharmacy department personnel during the next year would methodically go through all of the existing materials and ask themselves the question which again relates to that already mentioned, "Are these materials those which we can use in more efficiently accomplishing our objectives of instruction?"

Having once determined the status of existing audio-visual materials, our pharmacy professional group should then coordinate all of their individual screening through the publication of courses of study and lists of audio-visual materials through which these courses of study may be further implemented. That this is no idle dream may be demonstrated by the fact that teachers in the areas of the social studies, science, physics, home economics, physical education, industrial arts, vocations and guidance have done just that, much to their own enlightenment, much to their own enthusiasm in terms of countless materials which they are now bringing, as a matter of course, into their classroom work.

A second possibility may be that of creating one's own materials. Materials which specifically relate to one's own teaching problems may not be in existence. Such a case might be cited in terms of the teaching of history of pharmacy. Why is it not possible for a museum curator, a methods man in pharmacy history, and a good photographer to re-enact in authentic terms the highpoints of the history of pharmacy? In short, to create a teaching material?

V. Summary

The materials of audio-visual education and their techniques are fast becoming of increasing concern in the public school system of America, in elementary schools, high schools and colleges. Many departments of the University of Wisconsin have established committees to investigate the existence of audio-visual materials in their subject areas. Here on our own campus at Wisconsin as many as 1200 reels of sound-motion-picture films are shown in the several departments during a single school month. Over 30 pieces of audio-visual equipment are circulated and operated by 10 operators in the various departments of this institution.

The picture in our public schools of America is equally intriguing. Here in our state of Wisconsin, thousands of sound projectors are becoming integral parts of classroom teaching techniques. Certainly, this new avenue to effective communication of ideas is one which the teachers of pharmacy of this country should investigate, not in terms of a landslide of enthusiasm but rather in terms of a systematic approach to the question: "Are there possibilities for the even further improvement of learning environments in the schools of pharmacy in the nation through existing audio-visual materials or through the creation of audio-visual materials specifically aimed at the better teaching or difficult areas of instruction?"

In a further investigation of these problems, the University of Wisconsin Bureau of Visual Instruction will be glad to offer any assistance, or counsel, or to participate in any planning which might ultimately lead to an even greater teaching efficiency in the campus department of pharmacy.

ERRATA IN OCTOBER 1949 ISSUE OF THE JOURNAL

Under **Contents,** change line 7 to read.—The **Early** Days of the Pharmacological Society—**Torald Sollman.**

In the **Minutes of the Executive Committee,** page 750, line 26, change the last sentence in the paragraph to read,—Committee **I on Function of the American Association of Colleges of Pharmacy** and Committee **J on Office** of Permanent Secretary of the A.A.C.P.

Suggested Methods for Achievement Testing

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Observing the student in the laboratory is one means of gathering evidence of the extent to which he is developing important skills and attitudes. As an aid to this observation, check lists may be constructed that provide for recording relevant facts, such as what he does, the manner in which he does it, and the quality of the product. The following illustration suggests a form for such check lists. It should be noted that with a form such as this, the sequence of the students' actions can be recorded by using the numbers 1, 2, 3, etc., opposite the items in the first column.

*Individual Test of Skill in Using the Microscope**

Name_____ Class_____ Date_____

Student's Actions:

_____a. Takes slide
_____b. Wipes slide with lens paper
_____c. Wipes slide with cloth
_____d. Wipes slide with finger
_____e. Moves bottle of culture along the table
_____f. Places drop of culture on slide
_____g. Adds more culture
_____h. Adds water
_____i. Hunts for cover glass
_____j. Wipes cover glass with lens paper
_____k. Wipes cover glass with cloth
_____l. Wipes cover glass with finger
_____m. Adjusts cover with finger
_____n. Wipes off surplus fluid
_____o. Places slide on stage

Etc.

Noticeable Characteristics of the Student's Behavior:

_____a. Awkward in movements
_____b. Dexterous
_____c. Slow and deliberate
_____d. Very rapid
_____e. Fingers tremble
_____f. Does not take work seriously

Etc.

Characterization of the Student's Mount:

_____a. Poor light
_____b. Good light
_____c. Smeared lens
_____d. Something on the objective

Etc.

*Adapted from: Ralph W. Tyler, **Constructing Achievement Tests**, Ohio State University Press, 1934, pp. 37-41.

The Essay Test

The essay test is probably particularly well adapted to determining students' ability to:

Compare and contrast

Summarize or outline

Explain or analyze

Illustrate rules or principles

Apply rules or principles to unfamiliar situations

Criticize or evaluate

Suggest courses of action

Etc.

The scoring of essay tests is a major problem. These practices are helpful:

Prepare in advance a model response to each question. Designate the essential parts of this response and, if desired, weight them so that their sum adds to the number of points for that question. It also may be desirable to specify for each question typical errors or misconceptions that are to be weighted negatively if they appear in a student's answer.

If more than one person is to read a group of examinations, they should go over these anticipated responses until there is substantial agreement among readers. This can be checked by having each reader independently score the same paper, which has been duplicated for this purpose.

Score each question separately. That is, score, say, question 1 for all papers before proceding to question 2 for any student. The attempt to score the complete essay examination for one student before going on to another student's examination nearly always results in a shift in standards as the reader proceeds.

If it is not possible to assign points to each question, it should be possible to sort the responses to a given question into three or four categories that differ in merit. Each question can then be graded separately.

In administering an essay examination, inform the student of the weight to be assigned to each question. One method is to specify a working time for each question. Then this working time, in minutes, can be used as the total number of points for that question.

More elaborate weighting systems are seldom worth the time required to apply them.

Completion or Fill-in Exercises

Completion or fill-in exercises require recall rather than simple recognition. As such they are useful in determining students' ability to solve calculation problems, to recall or produce precise technical terminology, to state important facts about events, etc. For example:

What dilution factor should be used to dilute 100 cc of a 10% dextrose solution to make it isotonic with blood?
If 7 gm. of iron unite with 4 gm. of sulphur, how many gm. of iron sulphide will be produced?

What is the proprietary name for scopolomine?

Event	Country	Date	Person
Discovery of penicillin, etc.	_____	_____	_____

In preparing such exercises:

The direct-question form is usually preferable to the statement form.
Let the required response be as brief as possible
Avoid textbook language so far as possible.
Attempt to word the questions so that there is only one correct response for any given question. This will facilitate objective scoring.

Arrange the questions so that the student places his response in

blanks at either the right or left margin of the sheet or both (2 columns of questions). The student will be able to work more rapidly if the question is set up in several short lines in a column rather than one or two long lines that extend across the page. Such a form demands fewer eye movements in reading the question.

Two-Response Exercises

True-false or yes-no exercises have been used extensively to determine students' familiarity with events, principles, processes, etc. Often such exercises are made by selecting a number of statements from the text and modifying about half of them to make them false. This procedure may motivate a rote memorization of the text on the part of the student.

One difficulty with the true-false is that it is almost impossible to write a "true" statement of any generality without using qualifying terms that give the student a clue. Terms like "all", "always", "never", "none", etc., tend to signal a false statement.

Another difficulty is that many statements are complex, that is, they actually consist of two or more parts, each of which may be either true or false. If clear instructions are not given, students may adopt different sets or policies in responding to such statements. Lengthy, figurative, or involved statements may test only reading skill, rather than what was intended.

Restricting the student to two responses (true or false, yes or no) may be unrealistic. Some statements are irrelevant rather than being either true or false.

Because it is extremely difficult to develop a true-false test that cannot be answered to some extent by rote memory of lectures and the text and by testwiseness on the part of the student, it is often recommended that such tests not be used. Modifying the test to provide more than two responses, which makes it a multiple-choice form, or to demand that the student support his judgment for all items he marks false may be useful techniques. For example:

To the student: Read each of these statements regarding solubility and decide whether it is true or false. If it is completely true, circle the "T"; if it is false, circle the "F", and then write in, in the space to the right, the exceptions that make the statement false in whole or in part.

Chlorates are soluble in water T F _____

_____

Nitrates are soluble in water T F _____

_____

Etc.

Matching of Master List Exercises

Matching or master list exercises may be useful in testing students' ability to recognize related cause and effect, process and product, etc. For example:

Drug	Effect	
1. Adrenalin	Relieves pain	_____
2. Digitalis	Acts as a vaso-dilator	_____
3. Morphine	Acts as a vaso-constrictor	_____
4. Nitroglycerine	Relieves pulmonary edema	_____
5. Theobromine	Acts as a cardio-respiratory stimulant	_____
	Depresses the S. A. node, and acts as an auricular pacemaker	_____
	Facilitates breathing and increases hemoglobin content	_____
	Directly stimulates the heart muscle	_____
	Relieves joint pain in rheumatic fever	_____

An unequal number of items in the lists to be matched prevents answering some items by elimination.

Each list should be labeled and be homogeneous, rather than mixing, say, causes and effects in the same column.

It may be desirable to have a given item the correct answer for more than one of the responses.

See Tyler, op. cit., pp. 41-52, for further illustrations.

Multiple-Choice Exercises

As a rule, either four or five choices are used with multiple-choice exercises. It is difficult, even for adults, to follow a long line. Setting items up in this fashion presents an eye-movement problem for most students:

1. A child has swallowed lye. His mother has soda, epsom salts, castor oil and vinegar in the house. What should she do?

(a) Give him a mixture of soda and vinegar.

(b) Make him drink a cup of vinegar solution.

(c) Give him a dose of castor oil.

(d) Give him a dose of epsom salts.

A half-page column is much easier to read. The items below are given in that format.

It is desirable to adopt a style for punctuations and capitalization and to use it consistently. Some persons always capitalize the first word in each of the responses, whether or not they are independent sentences, and always follow them with periods. Others omit the periods. Still other punctuate as if the responses were part of a sentence that was started in the stem. (#1 above illustrates this.) The criterion should be ease of reading.

Writing items in simple English that avoids ambiguities and faulty usage is desirable. These illustrate poor practice:

2. When a union tries to win members away from another union, it is known as

(a) racketeering

(b) mass picketing

(c) raiding

(d) cross picketing

3. **An important event is**

   (a) **a fool deserts his king**

   (b) **a duke banishes his niece**

   (c) **a son kills his father**

   (d) **a soldier returns from war**

4. **Evangeline finds Gabriel**

   (a) **in a prison**

   (b) **in a hospital**

   (c) **in an Indian hut**

   (d) **not at all**

5. **Cancer unless treated results in**

   (a) **new cancer growths in other parts of the body**

   (b) **a growing resistance to cancer in other parts of the body**

   (c) **a natural cure in most cases**

   (d) **the article doesn't say**

Economy of phrasing is usually desirable, providing that all the pertinent statements are included. Number 1, above, could be rewritten to take less space, as follows:

1. **A child has swallowed lye, his mother has soda, epsom salts, castor oil and vinegar in the house. She should give him a**

   (a) **mixture of soda and vinegar**

   (b) **cup of vinegar solution**

   (c) **dose of castor oil**

   (d) **dose of epsom salts**

This revision also removes the clue in the original item that points to the *b* response as the correct one.

In writing multiple-choice items, we often take special care in phrasing the correct response, with the result that it tends to stand out. If one response is longer than the others, it is likely to be the correct one. If one response has a special emphasis (as the word *make* in the original 1, above), this is likely to be the correct response. Here are more illustrations:

5. The statement of a general truth that has been proved by careful experimentation is a

(a) scientific theory
(b) scientific law or principle
(c) hypothesis
(d) theorem

Note in number 5 that there is an exclusion clue also. Response *c*, "hypothesis" is obviously not the correct one, since the article *a* does not go with it. The stem was written with the correct answer in mind, and reflects this.

6. Which one of the following best illustrates a state of equilibrium?

(a) Water flowing over a dam
(b) An automobile coasting down a hill
(c) A balloon, motionless, just above the ground
(d) An airplane diving toward the ground

The absence of a verb in response *c* above tends to point to this as a correct answer. In general, parallelism in the responses is desirable, since it rules out such clues. Violating parallelism may result in an item like this one, which has only two effective responses for anyone who sees that *b* and *d* include all possibilities.

7. The number of deaths caused by cancer is

(a) more than the number caused by any other disease
(b) fewer than the number caused by heart disease
(c) fewer than the number caused by tuberculosis
(d) more than the number caused by heart disease

Pharmaceutical Calculations

(Abstract)

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The following outline is offered for a course in Pharmaceutical Calculations:

I. Systems of weight and measure: Metric, Apothecary, Avoirdupois, Imperial and Troy

II. Relationships between the various systems, between minim and drop, and between "household" units of approximate measure and units of the various systems.

III. Roman numerals

IV. Manipulation of quantities and units in same systems

V. Review of ratio and proportion

VI. Reducing and enlarging formulas

VII. Calculation of doses

VIII. Thermometric conversations (Fahrenheit-Centigrade)

IX. Specific gravity: water density-temperature relations, correction for water temperature, and methods for determining

X. Specific volume

XI. Weight-volume relationships

XII. Percentage solutions

XIII. Alcohol "proof"

XIV. Stock solutions and triturations

XV. Concentration and dilution

XV. Concentration and dilution

XVI. Alligation

XVII. Alcoholometric, acidimetric and alkalimetric tables

XVIII. Hydrogen ion concentration and pH

Observations over a period of years indicate to me that the students consider the "calculations" course one of the less interesting in the curriculum, therefore the instructor must put forth special effort either to make it more attractive or to "force" the student to learn the material. Interest can be added by the use of historical backgrounds when subjects such as weights and measures, thermometers, and specific gravity are considered. Lecture demonstrations as well as concurrent laboratory work also serve to arouse interest.

Compulsive measures include blackboard work under the eyes of the instructor and other members of the class, fifteen-minute quizzes every second lecture, and extra sessions for students who do not make normal progress. Retention of knowledge gained in this course has presented a problem which has largely been solved in late years by arrangements with instructors in succeeding courses to include in every examination questions in which the more important material of the "calculations" course is reviewed.

The student is expected to learn well the Apothecary tables for weight and volume. He is given the complete Metric system table but emphasis is placed only upon units such as the Kilogram, gram, milligram, micrograms, etc., which are most commonly encountered in pharmaceutical practice. The more exact conversion equivalents, i.e., 1 gram = 15.432 grains, are used. In later courses he will learn when the less exact equivalent (1 gram = 15 grains) can be safely employed.

Thermometric conversions give the student little trouble except with negative quantities. The foundation for specific gravity is established in prerequisite courses but pharmaceutical applications are taught in the "calculations" course. Temperature effects upon weight and volume seem to confuse the student, particularly in the "weight-volume" problems. The following formula is used.

$$\frac{\text{Weight of liquid}}{\text{Weight of equal volume of water}} = \text{specific gravity}$$

(1cc = 1 Gm)
(f℥1 = 455 gr.)
(m 1 = 0.947 gr.)

Weight-volume problems in the Metric system are not difficult but such problems in the Apothecary system become confusing. A line-by-line comparison of the same problem in the two systems helps the student to a clearer understanding. The problem: How much solute is required to prepare f℥i of a 5 per cent solution on prescription. The tendency is for the student to convert all quantities to the Metric system, solve the problem in that system, and then convert the answer back to grains.

Apothecary	Metric
f℥i of water = 455 grains	29.57cc. of water = 29.57 grams
455 gr.	29.57 Gm
x.05	x .05
22.75 gr.	1.48 Gm

Stock solution and trituration problems present little trouble to a student once he realizes that they must be solved "backward." As an example in the problem, "What should be the strength of a stock solution of mercuric chloride one fluidram of which, diluted to one-half pint with water, will make a 1:2000 solution?", the grains of mercuric chloride in the one-half pint of dilution must first be calculated.

Although some teachers speak deprecatingly of alligation it is still a useful tool in solving some pharmaceutical and chemical problems.

We have found that setting up higher algebra and trigonometry as prerequisite courses for Pharmaceutical Calculations has raised the performance standard of students in this course.

In my opinion the successful teaching of a course in Pharmaceutical Calculations is based largely upon two factors: (1) sufficient time for the teacher to present adequately the material and (2) willingness on the part of the teacher to devote time both to develop student interest and force him to learn. In my experience the usual method of presenting a course with formal lectures is far less successful than the use of frequent oral or

written quizzes. Successful teaching of a mathematics course is a matter of pressure on the student to study. This pressure can be maintained by making the student show at frequent intervals what he has learned.

Pharmaceutical Technique

(Abstract)

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In summarizing my brief discussion, I have raised the question as to whether the position taken by The Pharmaceutical Survey and the Committee on Curriculum of the American Association of Colleges of Pharmacy in recommending the deletion of the course in pharmaceutical principles and processes (pharmaceutical technique) from the pharmaceutical curriculum is in the best interest of sound pharmaceutical education. I have indicated that in my opinion the reasons stated by the consultative committee of The Pharmaceutical Survey, (viz. (1) the courses are elementary in character and (2) they duplicate many principles and processes that are regularly taught in chemistry, physics, and biology, and (3) they are taught with little or no reference to the scientific principles involved) for their recommendation are not convincing. It is my contention that we still need to teach these fundamental processes, and that if we do not continue such instruction as a separate course, we will find it necessary to integrate this material into the other courses in pharmacy.

In the second part of my paper I have discussed a course of study especially designed to meet the needs of the beginning student with reference to the fundamental principles and processes of pharmacy. A list of topics has been submitted covering a total

of 85 entries covering the following subdivisions: (1) fundamental principles (2) physical properties of matter, and (3) pharmaceutical processes.

The laboratory method has particular significance in the teaching of pharmaceutical technique and is considered indispensable to a course of study in this area.

Suggested Outline for the Study of the

Principles and Processes of Pharmacy

(Pharmaceutical Technique)

Adsorption
Archimedes Principle

Boiling Point Determinations

Capillarity
Carbonization
Centrifugal Decantation
Centrifugal Filtration
Centrifugal Straining
Centrifugation
Clarification
Coagulation
Cohobation
Colorimetry
Comminution
Condensation
Congealing
Continuous Extraction
Continuous Filtration
Crystallization

Decantation
Decoction
Decoloration
Decrepitation
Deflagration
Density
Deodorization
Desiccation
Destructive Distillation
Diacolation
Dialysis
Digestion
Distillation

Ebullition
Elutriation
Emulsification
Enfleurage
Evaporation
Expression
Exsiccation
Extraction

Filtration
Fusion

Garbling
Granulation
Grinding

Homogenization
Humidity

Ignition
Infusion

Levigation
Lixiviation
Lotion

Maceration
Mechanical Subdivision of Drugs
Melting Point Determinations
Metrology
Milling
Molecular-Motion Theory of Heat
Moments, Principle of

Optical Rotation

Percolation
Precipitation
Pulverization by Intervention

Refraction
Refrigeration
Repercolation

Separation of Immisible Liquids
Sifting
Solution
Solution by Circulatory Displacement
Specific Gravity
Specific Volume
Steam Distillation
Sterilization
Sublimation
Surface Tension

Thermometry
Torrefaction
Trochiscation

Ultra Filtration

Vacuum Distillation
Vapor Pressure
Vaporization
Viscosity

Weighing

Professional Nomenclature

(Abstract)

CHARLES O LEE

Professional nomenclature includes learning not only the names peculiar to the profession, but their derivation and meaning also. Correct pronunciation and spelling are a part of the task of learning any professional language, and for those who have acquired careless habits of speech and spelling the problems of nomenclature become more of a learning task.

The English language is not a pure one but a conglomerate of several languages. However, it is essentially rooted in Latin. Since modern scientific and technical names and terms are com-

monly made up from the Latin and ancient Greek, the professions of pharmacy, medicine, and dentistry, are confronted with the necessity of understanding some Latin and Greek as well as English. For example many of the sciences have "ology" as a suffix, namely, biology, zoology, geology, physiology, and pharmacology. The term, "ology", stems from the Greek word, logos which is translated in the gospel of St. John as the *Word*. However, in the Greek, its meaning is much more than is implied in *Word*. The word, biology, is a term which stands for the "All in all" of life, broad, comprehensive, and mysterious, but we use it in a restricted sense today. The term, Pharmacopoeia, is derived from two Greek words, (pharmakon) drug and (poieo) make. The fact that our first Pharmacopoeia (1820) was written in two languages, Latin and English, makes us realize that the profession of pharmacy is removed by less than a century and a quarter from a thorough knowledge of Latin.

Pronunciation

Pharmacists, except in rare instances, are much too careless in pronouncing words in everyday use. It is not uncommon to hear such words as digitalis, hyoscyamus, tragacanth, sapo, petrolatum, and many others, mispronounced in English. To add to the confusion of pronouncing both the English and Latin title, the so called Roman Method is used for the Latin terms. There is nothing to be gained by promoting this method of pronunciation which nobody knows. The English method, which is pronouncing according to the rules of Webster's Unabridged Dictionary, should be the one used. Helpful exercises in the classroom should be of assistance.

In the use of the Latin terms certain differences from the English should be expected. For instance the word, aloe is pronounced al′-ō in English but al′ō-ē in anglicized Latin. It is not possible here to go into orthoepy, the art of correct pronunciation, except to suggest that it can be acquired by studying the markings of the vowels and syllables of words which are found in the standard dictionaries. In addition to the problem of pronunciation

of the Latin titles there are also those of word order and a variety of endings. These follow general rules which are not too difficult to understand. As English speaking pharmacists let us all have sufficient pride in our calling to pronounce our professional terms correctly.

The chemists have similar problems. In 1934 there was published in the Industrial and Engineering Chemistry (May 20, page 202) "A Report of the Nomenclature, Spelling, and Pronunciation Committee" of the American Chemical Society. Three columns of this 8 column report are given to a discussion and explanation of the problems of pronunciation, with much attention given to word endings. The remaining 5 columns consists of chemical words arranged alphabetically and marked for pronouncing. We in pharmacy seem not to see the value of furnishing aids to pronunciation.

Naming Synthetic and Protected Items

Perhaps our most difficult task is to find acceptable names for complex, synthetic chemical medicinals which appear annually in great numbers. Students feel that they should not be burdened with the problem of learning more than one name for a chemical compound. They feel also that, where possible, the title should reveal the chemical character or structure of the compound. A point in case is that *ethyl carbamate* is a better technical name than ***urethane*** for the chemical in question. Moreover, there is no justification for multiplying the names for such items.

On the other hand the Council on Pharmacy and Chemistry of the American Medical Association gives consideration to trademarked names for new drugs submitted for description in "New and Unofficial Remedies". Concerning protected names it states that, "The Council therefore deems it advisable to accept several protected names for the same article, provided there are no reasons which would render this especially objectionable and harmful, and provided the common or generic name is not unduly subordinated to the protected name, in the opinion of the council. This means

that accepted drugs should always be identified by adding the generic or official name when the protected name is used, as for example, "Luminal, brand of phenobarbital," and "Benzedrine, brand of amphetamine". (Official Rules of the Council, page 16)

The problems of nomenclature include not only questions of pronunciation, spelling, word order, and endings of English and Latin titles, but also the choosing of meaningful names for synthetic chemicals and trademarked items. These latter problems cannot be settled in the class room but they are very keenly felt by students.

Application of Physical Principles to the Preparation of Pharmaceuticals

(Abstract)

FRANK M. GOYAN

University of California

There is a profound difference between learning to apply *principles*, and learning *rules* that others have developed by applying the same principles. It should be the objective of pharmaceutical education to teach students to become capable of applying scientific principles independently. This is especially true of the application of those principles of physics and of chemistry commonly accepted as elementary physical chemistry.

It is the author's belief that the best method of teaching the essential applications of physical principles to pharmacy is to provide a required course in physical chemistry for undergraduate students in colleges of pharmacy. Although it is possible to attain the same objectives by other means, there is grave danger that instruction in fundamental physio-chemical principles offered incidentally in other courses may be lost to all but the exceptional

student. The average student tends to concentrate his study on those phases of a course that seem most likely to contribute largely to the examinations, taking a calculated risk that a minor, though difficult, part of a general course may be overlooked with impunity.

It is, of course, assumed that certain prerequisite courses have been completed before beginning the study of physical chemistry. Normally, these prerequisites include elementary chemistry, analytical chemistry, first year college physics, at least one course in organic chemistry (preferably including laboratory work), and mathematics. A working knowledge of algebra including logarithms is an absolute minimum. Successful presentation of physical chemistry depends upon drawing from the student's mind his early recollections of the fundamental concepts obtained in these beginning courses. There can be little accomplished in the relatively short time devoted to physical chemistry in the curriculum of the average College of Pharmacy unless great pains are taken to co-ordinate principles learned or at least encountered before. In presenting the subject of physical chemistry in Colleges of Pharmacy, it is desirable to break away from the usual order of presentation in order to guarantee adequate review of basic concepts of energy and equilibrium very early in the course while there is yet time for the student to orient himself with respect to his physics and analytical chemistry, and to remedy deficiencies in his own background.

The elementary course in physical chemistry may begin with a brief review of atomic and molecular structure, followed by the presentation of basic concepts of energy and equilibrium, with special emphasis on phase equilibrium and chemical equilibrium. Rate of reaction may be presented as an outgrowth of the law of mass action. Colloidal chemistry, gas laws, kinetic theory, properties of the liquid and solid states of matter ,ideal solution laws, osmotic properties of electrolytes and non-electrolytes, electrical conductance, electrode potentials in relation to pH and oxidation, photochemistry, photometry, polarimetry, and other topics of special interest complete the course. Some laboratory instruction involving phase equilibria, buffers, reaction rate, colloid chemistry,

physical and optical properties of liquids, freezing point lowering determination, measurement of pH and other electrochemical properties, etc., is essential to provide a secure foundation for the lecture material.

Even though some may argue the administrative advantages of teaching a separate course in physical chemistry, none can deny the validity of the objective of presenting these basic principles of science in such a way that they become a part of the intellectual equipment of the pharmacist. Furthermore, it is not sufficient for the student to master these principles for a short time, only to forget them because of failure to make use of them in recurrent practical applications. His instructors must recognize the importance of early guidance in the application of scientific knowledge and technique to problems of vital interest in pharmacy. To accomplish this, instruction in certain phases of pharmaceutical preparation such as the manufacture of buffered solutions, calculations involving isotonicity of solutions, etc., should be developed sufficiently in the physical chemistry course to arouse interest and lay foundations for later detailed instruction. However, unless this later practical instruction takes the form of guiding the student in the application of concepts which he himself understands and is ready to apply, the objectives of education in this broad field cannot be attained.

The best evidence of the successful attainment of objectives in the physical chemistry course is obtained by the instructors in advanced courses in pharmacy. It is essential that any weakness on the part of the senior students be reported back to the source of the weakness. A series of six or more examinations of as many different types as possible given during the physical chemistry course serves to keep students and instructors informed concerning student accomplishment. However, the most effective technique so far discovered for stimulating interest and at the same time discovering weakness in student preparation is to arrange for each student in the course to assume a real share of the responsibility of instruction. Each student gains the feeling (and justifiably so) that he is an expert in some one preassigned phase of the work

and that others depend upon him to instruct the entire class in the intricacies of his specialty.

Colloid, Emulsions and Suspensions

(Abstract)

T. HIGUCHI

University of Wisconsin

Although nearly all teachers of pharmacy are agreed that colloidal science should be included in the pharmaceutical curriculum, there is much less agreement on how it should be taught. Some of the teachers feel that only purely applied aspects are necessary; others favor a much more fundamental approach based on mathematics and physical chemistry.

The latter view is presented together with a concept of how colloidal science and other topics in physical pharmacy could be taught if pharmacy students were provided with an adequate background in the basic sciences including physical chemistry. An outline of such a course is discussed, the emphasis being always on the quantitative possibilities of recommended approach.

It is pointed out that a quantitative knowledge of such factors as stability of pharmaceutical emulsions, partition of therapeutic agents between two phases, and rate of drug diffusion should be among the working tools of a professional pharmacist. These are unquestionably pharmaceutical problems. It is further pointed out that if pharmacists of tomorrow are not trained in this area, pharmacy as a science will cease to exist.

Flavoring, Coloring, Masking Agents, Techniques and Preparations

(Abstract and Outline)

STEPHEN WILSON AND SYLVAN M. SAX

University of Pittsburgh

Objectives

1. General

The general objectives for this material are identical with those for General Pharmacy *2* as listed in the preliminary report of the Advisory Committee on Pharmacy for the Pharmaceutical Survey.

2. Specific

A. Development of an esthetic appreciation for, and a realization of the importance of, pharmaceutical elegance in preparations and prescriptions.

B. Familiarity with the natural (animal, vegetable, mineral) and synthetic colors used in preparations and skill in the techniques involved in their use.

C. Familiarity with the agents used to flavor, to sweeten and to mask undesirable tastes and odors of necessary ingredients in pharmaceutical preparations and skill in the techniques involved in their use, and

D. The development of ingenuity and creative thinking in the application of the knowledge and skills to 1) product formulation, *2*) the extemporaneous compounding of prescriptions, and 3) advising physicians on prescription construction.

I. Introduction

A. Definitions:

B. Physiological basis:

C. Psychological basis:

D. Classification of flavors:

E. Classifications of Colors:

II. Flavoring and Masking Agents

A. Chemistry of flavoring agents:

B. Official Flavoring and Masking Agents:

1. Animal and Vegetable		**2. Organic Chemicals**
3. Powders	**4. Oils**	**5. Waters**
6. Syrups	**7. Elixirs**	**8. Spirits**
9. Tinctures	**10. Fluid Extracts**	**11. Oleoresin**
12. Extracts	**13. Juices**	**14. Wines**
15. Gases		

C. Unofficial Flavoring and Masking Agents:

2. Flavoring Extracts	**1. Syrups**
4. Waters	**3. Imitation Flavoring Extracts**
6. Others	**5. Juices**

D. Specific Information applicable to each official and unofficial Flavoring and Masking Agent should be considered with each item under B and C.

1. **Flavoring and taste masking qualities**
2. **Chemistry**
3. **Techniques of preparation and use**
4. **Preservation of flavor**

E. Possibilities for Development of Flavoring and Masking Agents

F. Sugar-free Flavoring and Masking Agents for Diabetic Patients

III. Coloring Agents

A. Introduction
1. Incidental vs. intentional coloring principles
2. Classification of coloring principles

B. Animal Coloring Principles
1. Cochineal 2. Carmine

C. Vegetable Coloring Principles
1. Chemical Classification and properties
2. Official Vegetable Coloring principles
3. Unofficial Vegetable Colors

D. Mineral Coloring Substances
1. Titanium Dioxide 2. Oxides of Iron

E. Artificial Coloring Principles
1. Legal Definition
2. Restricted Class — Coal Tar Dyes
   a. Legal Definition
   b. Qualifications for Certification
   c. Classification
   d. Advantages
   e. Official Coal Tar Dyes

1V. Aesthetic Factors
A. Importance
B. Pharmaceutical elegance
   1. Clarity of liquids
   2. Uniformity of powders

Teaching Methods

I. Lecture

II. Lecture-Demonstration

III. Discussion-Demonstration

IV. Laboratory

V. Problem

Evaluation

Mean

1. **Recognition and Recall tests**
2. **Essay-type questions**
3. **Observation and rating with a check-sheet**
4. **Written laboratory reports**
5. **Evaluation of products or preparations**

Problems

1. **Psychological factors**
2. **Individual differences**

Advanced Pharmaceutical Technology Preparations for Local and Systemic Use

(Abstract)

ALLEN I. WHITE

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The objectives of accomplishments for the proposed course are based on the premise that the students have had courses in biology, mathematitcs, chemistry, and such professional courses so that they are familiar with the basic terminology, principles, and skills of pharmacy. It is also assumed that the students have had a course in "Physical Pharmacy". The objectives proposed are:

1. **An ability to determine what is the best pharmaceutical preparation possible for the purpose for which a given medication is to be administered, whether for local or for systemic effect.**

2. A comprehensive knowledge of the properties which a preparation for local or systemic use should have to best accomplish its intended use and to achieve and maintain its best pharmaceutical characteristics.

3. A development of the degree of skill necessary to safely and nicely manufacture the desired preparations.

4. A comprehension of some skill in the measurement of the characteristics wanted in a desirable preparation.

It is suggested that the material of the course be organized so that the various types of preparations which may be utilized for similar medicinal objectives are studied together. Accordingly, the subject matter is divided into a few large groups with the material to be considered under each as follows:

1. Preparations for Oral Administration (Not including elementary preparations or dosage forms).

   a. General requirements and features.

   b. Problems in the manufacture, preservation and storage of special solutions.

   c. The properties, uses, manufacture and stabilization of suspensions.

   d. The uses, properties, manufacture and stabilization of emulsions.

2. Preparations for Parental Administration.

   a. General features, advantages and disadvantages.

   b. The different types, emphasizing the desirable properties of each.

   c. Problems and techniques in manufacturing.

   d. Containers, packaging and storage.

   e. Control testing.

3. Preparations Applied to Mucous Membranes.

a. Preparations Used in the Eye.
1.) General Requirements.
2.) Types of preparations and the uses, advantages and disadvantaves of each.
3.) Methods of achieving desirable properties and techniques of manufacture.
4.) Preservation, packaging and storage.

b. Preparations Used in the Nose and Upper Respiratory Tract. (Detailed treatment same as under a.)

c. Preparations Used in the Ear. (Detailed treatment same as under a.)

4. Preparations for Genito-Urinary and Rectal Administration.

a. General requirements.

b. Types of preparations, their properties and manufacture.

c. Preservation, packaging and storage.

5. Preparations for Dermatological Use.

a. General requirements and uses.

b. Comparative properties and uses of different forms of application.

c. Problems and techniques of manufacture.

d. Preservation, packaging and storage.

The method of teaching recommended is the traditional lecture-laboratory arrangement. Emphasis is placed on developing a use of the current literature. Reference is made to the use of films. A careful blending of experiments which develop technique and demonstrate known facts with a few experiments bringing in research features is recommended for the laboratory sessions.

For evaluating the students accomplishments, objective type examinations are recommended to cover the factual data and problem questions are suggested to test the students ability to solve pharmaceutical problems within the area.

Special Techniques and Agents in the Manufacture of Dosage Forms

(Abstract)

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The problems confronting a teacher of advanced pharmacy involving dosage forms of medication are rather broad and far-reaching. There are a large number of dosage forms in medical use and the teacher must determine the value of each form before including it in his course.

The teacher should cover material in a course of this type which will give a student a working knowledge of each dosage form including both small and large scale manufacture. The problems of converting from the small scale to large quantity manufacture are not difficult ones to overcome. They are, as a rule, problems involving technics.

A check of several prescription surveys, shows that the following dosage forms should be included in a course of this nature. Ampuls, capsules, pills, powders, suppositories, tablets, tablet triturates lozenges, and troches. Each heading was presented under the following outlines: Definition, uses, vehicles, preparations (hand and machine), formation, equipment, storage and control.

The objectives therefore should consist of the following:

The course content is presented to give the student

1. An understanding of the use of dosage forms in pharmacy and medicine.

2. An understanding of the technics and skills needed in manufacturing these dosage forms by hand and by machine.

3. An understanding of the problems of formulation and development of dosage forms.

4. An understanding of the methods of analysis and control.

The best methods of presenting this material are by lecture, demonstration, and laboratory work with emphasis upon manipulative procedures in the laboratory. The problem of machine production will depend upon the finances and resources of the various schools in which a course of this type should be presented. An outline was then presented in detail for the presentation of subject matter.

The best procedure to evaluate the student is a debatable one. Examinations may be of several types followed by laboratory testing procedure. The student in my judgment should be graded on the basis of actual laboratory technics and skills. His ability to manipulate the various pieces of equipment and his general attitude towards the work he does. The care with which he does his work can be determined by the end results of his labors, the finished product.

The Termnial Course in Pharmacy Dispensing Pharmacy

(Abstract)

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University of California

I. The Objectives

The scientific developments of the past twenty-five years in the areas ambracing the pharmaceutical, medical, dental, and public health fields have brought about significant changes in our

concept of the pharmacist as a professional man, of the meaning of the term "adequate pharmaceutical service," and of certain needs in pharmaceutical education. Since the inception of The Pharmaceuical Survey in 1945, we have been particularly conscious of certain practices in pharmaceutical education the basis for which seems to be one of precedent rather than one of demonstrated need. The analysis of existing curriculum defects has of necessity focused attention on individual courses where questions dealing with course objectives, course content, course sequence in relation to other courses, and effective teaching methods have been raised.

The present paper is the first in a series designed to be a special treatment of the terminal course in pharmacy which largely by precedent has become known as Dispensing Pharmacy. It was prompted by (1) problems in our own curriculum at the University of California that relate to Dispensing Pharmacy, (2) apparent inadequacies of the classical treatment of this area in light of the present and anticipated future needs in pharmacy, and (3) apparent inadequacies of The Pharmaceutical Survey treatment of Dispensing Pharmacy.

With due respect to the Subcommittee on Pharmacy of The Pharmaceutical Survey Committee on Curriculum, the treatment of Dispensing Pharmacy seems to be inadequate for two reasons: (1) the time allotted for the course in order to accomplish the stated objectives seems excessive; (2) the area provided for the terminal course is confined almost entirely to dispensing techniques.

The precedent for the classical approach to the area of Dispensing Pharmacy was established many years ago when the professional responsibilities of the pharmacist were confined largely to the preparation and dispensing of the various types pharmaceutical preparations. The pharmacist's professional obligations were restricted to rather narrow limits when compared to his present-day obligations. The pharmacist was looked upon solely as one skilled in the arts and details of pharmaceutical procedures and the course in Dispensing Pharmacy was designed to meet these empirical needs.

If the pharmacist's formal education is to contribute to the professional poise and autonomy that we believe are becoming to the profession of pharmacy, the curriculum in pharmacy must contain portions in which these broader but none the less important aspects of pharmaceutical service are emphasized. The terminal professional course in pharmacy, if it is to be worthy of senior status in the university, must bring a forceful climaxing of the previous instruction in the biological and physical sciences and then must spread out to include adequate instruction in those ancillary fields which at the present time are vital in the practice of pharmacy.

The following objectives are suggested for the terminal professional course in pharmacy.

1. To utilize the background courses in the physical and biological sciences for effective correlation between the theory and the practice of pharmacy.
2. To encourage creative and independent thinking in the student.
3. To provide instruction in the fundamental techniques and disciplines of prescription compounding and dispensing.
4. To provide instruction in the specialized pharmaceutical techniques which in themselves require particular considerations and which are often presented to the pharmacist as individual problems in medication.
5. To present certain interprofessional interests and problems through the cooperation of qualified members of the medical and dental groups.
6. To emphasize the therapeutic aspects of medicinal agents.
7. To emphasize constantly the responsibility of the pharmacist as one authorized by legislation to distribute drugs and poisons to members of society.
8. To present a certain introduction to the area of proprietary drugs.
9. To emphasize the value of medicinal agents and standards as set forth by recognized drug compendia.
10. To present the latest information pertaining to new drugs and to recent drug developments.

Whatever objectives are finally selected for a particular terminal course in pharmacy, a measure of their suitability may be obtained through the application of the following questions: (1) will the course provide the student with a dynamic climax to the previous instruction in the physical and biological sciences; (2) will the course measure up to academic standards of upper division instruction within the university and yet maintain the necessary professional content; (3) will the course provide the student and teaching personnel with a confident, challenging, and stimulating approach to the practice of pharmacy?

II. Powdered Medication

Instruction in powders may be approached from five points of views: (1) powders as a form of medication with recognized advantages and disadvantages, (2) the pharmaceutical techniques required for the compounding and dispensing of powder dosage forms, (3) the physical properties of drugs used in powder medication which may dispose to special handling in dispensing, (4) new techniques for preparing and administering powder medication, and (5) the pharmacologic behavior of the individual drugs upon which their therapeutic usefulness is based. It is assumed that points one and two are interpreted readily and that for the most part instruction meeting these points is adequate in most schools of pharmacy. This discussion suggests the content and teaching methods for the realization of several aspects of points three and four and also suggests that powders might be presented to the student as representing a physical form of medication rather than as a pharmaceutical class. The fifth point is of prime importance but it does not present the particular teaching problems that are found in the two preceding ones.

Moisture is perhaps the most important single factor that complicates the formulation of powder medication. Moisture problems are identified with the following phenomena (1) the relative humidity of the air, (2) the water of hydration of a compound, (3) the heterogeneous liquid-solid systems resulting from a mixing of certain substances, i.e., camphor and phenol.

The intelligent understanding of moisture problems in pharmaceutical dispensing is not complicated by the scientific involvement, rather it is made easier. The student must first *see* the problem in the laboratory, and then set about to correct it. This approach is sound and the student recognizes the value of such inert materials as magnesium oxide and starch as suitable for overcoming moisture problems with certain powders; he understands the rational for using wax papers where a high relative humidity exists; he appreciates the need for tightly stoppered containers for bulk powders. But to the student who has had a reasonable orientation in physical chemistry, this approach is not fulfilling. Dispensing pharmacy at this point fails unless the proper climax can be effected whereby the terminal course will attain its foremost objectives. The instructor must see that the student not only understands the "How?" but also identifies the "Why?".

Instruction in powders need not be confined to the usual bulk and individual powders. Many of the products which the pharmacist dispenses are available as powders resulting from special methods of processing. Lyophylyzing techniques have been adapted to the preparation of many biological preparations, thereby making them available in powder form. Inhalation of drugs in an extremely small state of subdivision is finding increased therapeutic advantages, hence aerosols are becoming increasingly important to the pharmaceutical discussion of powders. It remains for the teaching personnel to realize that basic instruction for much of this material is provided elsewhere in the pharmaceutical curriculum, and that in the terminal course the problem involves carrying the principles over so that the student may realize the application of such information in the formulation of medicinal agents.

Dispensing of Solutions

(Abstract)

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While the course content in dispensing can be divided into three parts as has been done here, the objectives are for the most part the objectives of the course as a whole. My one main objective has always been to turn out a good pharmacist. The objectives which follow are means to that end. Some of these objectives are:

Continuing to learn physical properties, such as solubility and appearance, by handling chemicals, and continuing to learn the solvent properties of the common solvents.

Learning to solve the arithmetical problems of extemporaneous solutions in the shortest possible time.

Coordinating the knowledge and skills acquired in previous courses as a basis for learning new principles and skills for the filling of prescriptions.

Laying the foundation for practical work in prescription filling in a drug store under the supervision of the pharmacist.

Developing confidence in the student of his own ability so that he will be prepared to accept the responsibilities connected with the filling of prescriptions.

Students absorb knowledge by doing. By handling chemicals, preparing solutions or suspensions, they acquire knowledge of appearance, crystalline structure, color and odor without being conscious that they are doing so. Likewise, when various solvents

are used, students become familiar with not only the solubilities of various substances in the different solvents, but often are able to make certain generalizations regarding the solvent properties of the various solvents. This particular objective can of course be advanced in any laboratory course in pharmacy and is not applicable to dispensing alone.

Learning to solve the arithmetical problems of extemporaneous solutions in the shortest possible time is another objective. In the course of Calculations we often are satisfied when the student uses a logical method and arrives at the correct answer. This method may, however, not be suitable for prescription work. The pharmacist cannot take time out to obtain pencil and paper and sit down to make lengthy calculations.

It goes without saying that students should be neat in their work. Neatness does not seem to concern chemists, but pharmacy students are expected to be neat in all their work whether it be botany, pharmacology or anatomy. It is especially important in dispensing.

In addition, the student is expected to analyze the prescription so that he can formulate a plan of work so that no time will be lost. He is expected to do the mechanical procedures, such as weighing and typing, rapidly and to develop the ability to think and to make decisions without vacillation.

A reasonable degree of accuracy is somewhat difficult to define. Goldstein has set certain limits based on results obtained in actual practice. These are more generous, more lenient, than should be applied to classroom work. Students should be expected to fill prescriptions with a tolerance which good pharmaceutical technique will produce with the laboratory instruments, i.e., balances and graduates which we provide. Carelessness ought not to be allowed but, at the same time, perfection should not be expected. The student should become aware of his responsibility to the patient. He should use the same care when filling prescrip-

tions in the laboratory as he would were the medicine to be taken by the patient.

Most of our students work part-time in a drug store during their senior year, and a number of them do so in their junior year. They are usually allowed to fill prescriptions under the supervision of the pharmacist. Since the main class of prescriptions which require compounding are liquids, the dispensing course is begun with that class of preparations so as to advance the student as rapidly as possible into the work most urgently needed.

We have all seen recent graduates, and some graduates not so recent, who have refused to accept the responsibilities connected with prescription work; those who always need confirmation of their work and who worry excessively when left alone in the store. We strive to develop confidence in the student in his own ability so that he will be prepared to accept the responsibility of prescription filling.

The contents of this part of the course includes calculations of doses and percentage solutions; the best methods of compounding and dispensing solutions of gases, true solutions, collyria, isotonic and buffered solutions, mixtures, and sprays. Isotonic solutions are prepared, making use of the sodium chloride equivalents.

The class of preparation is discussed first; then prescriptions are written on the board and discussed individually. As a rule, all students fill the same prescriptions. They keep a prescription file, numbering and dating the blank and writing on the back any information necessary for the refilling of the prescription. At the end of the year, prescriptions are filled without regard for the class of preparation.

Written examinations are varied, usually being a mixture of objective and subjective types. Students are quizzed orally and

individually during the laboratory period. Occasionally, an individual is required to make a percentage solution while the instructor looks over his shoulder. Practical examinations are held to test the student's knowledge, skill, and confidence. Two sets of prescriptions are used on the practical so that no student will have next to him, in front of him, or behind him another student having the same set of prescriptions. The prescriptions in the two sets are sufficiently alike so that anyone attempting to get help from his neighbor would only get hopelessly involved. For example, one might call for a 1:1000 solution and the other for a 1:2000 solution of the same substance.

At this Seminar, considerable stress has been placed on the subject of motivation. The reason I enjoy teaching dispensing is that students have a genuine interest in the subject. Ask a student what he is in college for, and he will answer that he came to learn how to fill prescriptions . It is up to the instructor to see that this interest is maintained.

The faculty of the University of Connecticut is pioneering in the production of 16mm. Kodochrome (silent) films in the field of manufacturing pharmacy. To date, films have been completed for percolation, pill making (by hand), suppository manufacturing (by hand and machine), and tablet triturates (by hand). The films have a running time of between 15 and 25 minutes. The films are, of course, an instructional aid in the demonstration of pharmaceutical techniques and are shown prior to the laboratory sessions. The film on pill making was shown at the Pharmacy Seminar at Madison, Wisconsin, last summer, by Dr. W. A. Wittich, as an example of what can be accomplished in the field of audio-visual teaching aids. Plans are now being made for the preparation of duplicates of these films, so that they may be loaned to interested teaching instituions. Prof. Nicholas W. Fenney has been the aggressive spirit behind this project.

Dispensing of Dosage Forms

(Abstract)

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Of all the courses in the pharmaceutical curriculum, that in dispensing most nearly approximates the professional activity of the pharmacist. It is, therefore, rightly regarded as the culmination of the curriculum; it is the course in which the student is afforded the opportunity of integrating and applying the knowledge gained in all of the other courses of study. It is a course in which very few new facts or concepts are presented to the student but in which he is taught, rather, to use intelligently and efficiently the knowledge he already possesses.

The prerequisites of the dispensing course are all of the courses that have been completed at the time the dispensing course is begun and, in a sense, of course, the studies that are undertaken concurrently. With particular reference to the subject under discussion, the dispensing of dosage forms, the prerequisite is the course in pharmaceutical preparations in which the student has received instruction on the several classes of dosage forms and has acquired some measure of skill in their preparation.

The objectives of that part of the dispensing course devoted to dosage forms are:

1. **To perfect the hand skills involved in order that acceptable products may be prepared rapidly and efficiently.**
2. **To perfect the technical procedures in order that the completed dosage forms may be quantitatively accurate within accepted limits.**
3. **To so train the student that he may be able to prepare the more difficult and unusual examples of each class of preparations.**

4. **To enable the student to recognize incompatibilities and to overcome them, if practicable.**
5. **To so train the student that the checking of doses becomes an ingrained habit.**
6. **To instruct the student in methods of packaging in order that the dosage forms may be properly preserved and be esthetically satisfactory to the purchaser.**

In order to achieve these objectives, the student should be required to compound prescriptions for each of the several dosage forms, the number of prescriptions for each type being governed, but not wholly, by the relative importance of the type in present-day prescription practice. The prescriptions should be carefully chosen to cover the whole range of customary practice and, in addition, as many unusual examples as can be procured. It is not necessary that each student prepare all of the examples if opportunity is afforded for inspection and discussion by all of the members of the class.

Neither in the classroom nor in the laboratory should the dosage forms be discussed or prepared as classes of preparations, since to do so would be to repeat that which had been done in a previous course. Rather, they should be interspersed with other types of prescriptions as they are customarily found in prescription practice. It cannot be too strongly emphasized that only by making the dispensing course truly representative of actual practice can we adequately prepare our graduates to assume their responsibilities.

The student's ability in the preparation of dosage forms may, to a certain extent, be evaluated by means of written tests or examinations. Far more important and reliable, however, is the evaluation carried out in the laboratory. This should be based not only on a critical and careful examination of the finished product but, also, on the result of constant and vigilant supervision by the instructor.

Incompatibilities

(Abstract)

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Since the proficiency of the pharmacist is in a large part measured by his ability to solve dispensing problems, most teachers of pharmacy are agreed that the study of prescription incompatibilities is an essential section of the pharmaceutical dispensing course. The study of prescription incompatibilities, however, should not be relegated to a routine memorization of many examples of type problems which arise in dispensing pharmacy, but should be placed on a sound scientific basis. Adequate scientific background should be developed in the student so that he is capable of solving those problems which arise with the advent of new drugs as well as the problems associated with the drugs used in present-day medicine.

One logical approach to the study of prescription incompatibilties is through the utilization of the electronic and solubility theories. The electronic theory is a valuable teaching aid which gains student acceptance due to the fact that the theoretical concepts are directly applicable to prescription compounding procedures and afford a manner of explaining both compatibility and incompatibility. With this background the student is capable of predicting incompatibilities and deciding upon the proper corrective procedures before any attempt is made to compound the prescription.

Several illustrations of the application of electronic concepts are included in the original paper.

It is pointed out that in order to keep pace with the rapidly advancing boundaries of scientific knowledge the teacher of pharmacy must utilize all pertinent scientific information at his disposal.

New and Non-Officials (Proprietaries)

(Abstract)

JOSEPH B. SPROWLS

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The most striking development which has taken place in pharmacy during the past fifty years has been the evolution of a vast pharmaceutical manufacturing industry. This fundamental change in the practice of pharmacy seems to reflect the accumulated result of a number of contributing factors, including the adaptation of the machine to pharmaceutical operations, the development of new dosage forms (particularly the tablet and the ampul) which are most satisfactorily prepared on the large scale, and the introduction of synthetic organic medicinals which are, on the whole, not well adapted to use in the older dosage forms which the pharmacist customarily prepared in his own place of business.

The intense interest displayed by manufacturing companies in the production of new therapeutic agents and the imposition of required control methods have led to the maintenance of research departments by most companies of any size. The research departments have, in turn, produced an ever-increasing number of new agents useful in the treatment of disease. Because the Food and Drug Administration regulations have eliminated most of the possibility of secrecy, the majority of new developments are of a patent or trademarked nature. Because of the labeling restrictions, many are limited to prescription use. Collectively these products have come to be spoken of as "manufacturers specialties" or as "prescription specialties".

Recent prescription surveys have revealed the extent of influence which manufacturers specialities have influenced the prescrip-

tion writing tendencies of practitioners. Surveys by Heine and Lee[1], Andrews[2], Plein and Rising[3], and Cataline and Bidwell[4] show an incidence of 41.3 to 64.8 per cent of prescriptions which call for proprietary* items as compared with an increase of 32.1 to 38 per cent of prescriptions calling for official items. The recent Pharmaceutical Survey determined that 60.8 per cent of all prescriptions call for at least one prescriptions specialty, while only 40.9 per cent call for at least one official item. Thus, the evidence is clearly before us that the drugs and preparations which the pharmacist uses today are largely of a class which are not recognized by the United States Pharmacopoeia and the National Formulary. Since the typical pharmaceutical syllabus of this country is now constructed upon the basis of the U.S.P. and the N.F., we feel that serious consideration must be given to the inclusion of courses or the revision of existing ones so that the student of pharmacy will receive that fundamental instruction which will aid him in working with non-official and proprietary forms of medication. We further believe that the ethical attitude which is now maintained by many manufacturers toward the advertising and distribution of their products makes information concerning these more acceptable to academic discussion.

We do not believe that the policy now in existence at several schools of offering a separate course entitled "New and Non-Official Products" or the equivalent is the best solution to the problem, because the number of hours relegated to such a course is in most instances an insignificant portion of the curriculum. Furthermore, by this method there is lost the possibility of correlating the non-official products with related official drugs and products which the student must also study. We prefer the inclusion of this material in courses such as those usually labeled "Medicinal Products" or the "Chemistry of Medicinal Products", where all chemical drugs can be considered whether of an official or non-official nature. Important objectives of the course should be those of familiarizing the student with sources of information concerning non-official and proprietary products as well as fa-

*The 64.8 per cent figure includes official items prescribed under a protected name 3.

miliarizing him with those products which are medicinally proven and are most important from the standpoint of incidence of use.

While it is difficult to determine which of the many prescription specialties should be included in a course of instruction (since their number precludes the possibility of including all), it is believed that the best guides are current editions of New and Non-Official Remedies, prescription surveys, and reports from local wholesalers concerning the products most popularly prescribed within the geographical area served by graduates of the college. Since familiarity with new products will require never-ending study and reading on the part of the practicing pharmacist of the future, we must instil in the student an interest in that literature from which such information may be obtained.

Visual aids, such as the display of original packages and original brochures and phamphlets will be found to be most helpful in maintaining the interest of the student and in providing him with further information concerning those products in which he or the instructor may be particularly interested.

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Outline for Hospital Dispensing

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Pharmacy as practiced in a hospital, like medicine and nursing, ascends to the maximum of its professional qualities. Hospital dispensing for the pharmacy student can be compared to the clinical instruction and contacts of the medical and dental student. It affords the student his first patient and inter-professional relations. All of the pharmacy student's professional training has been directed toward the preparation of an individual scientifically qualified and manually proficient in the principles and art of compounding medicinals for consumption by humans and animals. He has been instructed with the need for absolute accuracy; he recognizes the desirability of careful compounding and checking and the value of quality control, for in all his pharmaceutical operations these have been stressed. However not until his hospital out-patient dispensing training does he sense the responsibility of preparing for the consumer. It is during this period that the student applies the theory and practical instruction to the actual performance of his professional duties. His interpretation of the prescription must be correct. It is no longer a product to be discarded. It is the first time that he realizes the responsibility of compounding medication because he now is confronted with the patient for whom it is intended and by whom it supposedly is required.

The functional principles and processes of pharmacy are employed to the fullest extent in a hospital pharmacy. It is true that the basic principles involved do not differ from those outlined in any good course in pharmacy but the manner and application of the processes of dispensing and manufacturing require specialized techniques. In other words, their application must frequently be modified.

It is understandable that all colleges of pharmacy will not be in position to offer training in hospital dispensing because of location, make-up of the university or college, inadequate facilities or staff, etc. It is desirable that the in-service training in a hospital pharmacy be under the immediate supervision of a member of the college staff. It is preferable that the management of the pharmacy be under the general supervision of the dean or director of the college of pharmacy. Such arrangements, however, are not always possible; although, many hospital administrators are becoming aware of the value of such an association. The limitation of the professional practices of all groups in a hospital are influenced by:

1. **the type of institution**
2. **the administrative policy of the hospital**
3. **the facilities**
4. **the qualifications of the total hospital staff**
5. **the cooperation of the various departments**

It is also to be noted that hospitals of less than 100 beds would not serve adequately as a laboratory for thorough training in hospital dispensing. It would be highly desirable that our students receive experience in more than one type of hospital, primarily because they differ so markedly in the scope of their therapeutic policy. In the private or voluntary type hospital in which the medical staff is of the open or non-restricted type, it is easy to understand that the control and limitations on therapeutics is difficult to maintain. In a charity, state or municipal hospital (closed type staff) it is generally conceded that the therapy is more rational and more rigidly controlled.

The Chairman has requested that each of us furnish an outline of our suggestions and to include the objectives which the student should achieve through training in hospital pharmacy. As a member of the A.A.C.P. Curriculum Committee, and having con-

tributed to and agreed with the objectives submitted by this Committee, I have taken the liberty of using these objectives with slight modifications and additions.

1. **Gain a sense of personal responsibility. The responsibilities are limited to his professional activities.**

2. **Gain a knowledge of the several types of hospitals and their pharmaceutical requirements: General types both voluntary and charity; special clinical types such as: children's, women's, eye and ear, cancer, contagious diseases, tuberculosis, etc.**

3. **Gain a knowledge of the organizational plans of hospitals; relationships of management and professional staff.**

4. **Gain a knowledge of institutional purchasing and stock control.**

5. **Gain experience in manufacturing and quality control of pharmaceuticals on a hospital scale.**

6. **Gain familiarity with the functions of hospital laboratories and clinics.**

7. **Gain increased assurance in pharmacist-physician relationship.**

8. **Gain increased assurance in pharmacist-patient relationship.**

9. **Gain increased familiarity with the specialized literature of medicine and pharmacy.**

10. **Gain familiarity with the terminology and purposes of surgical instruments and supplies.**

11. **Gain increased appreciation of the need for specialized medication and cooperative research in this field.**

As I wlll point out from the discussion of the teaching outline, all of these objectives cannot be considered at an undergraduate level. The most that can be expected is to develop in the pharmacy student an assurance of his ability to perform the duties of his professional career. For example, one cannot acquire ex-

perience in the procedures of procurement and the control of supplies in a course of this type. It is strictly a professional dispensing service that we emphasize in this undergraduate work.

The following outline for a method of teaching hospital dispensing is presented for purposes of discussion. The variations in teaching methods must be modified to meet the policy of the hospital and the extent to which the college controls the teaching. I have tried to enumerate the fundamental points and hope from our current discussion to be able to expand the details of the outline.

It is important that the hospital pharmacists immediately associated with the students in their in-service training, not lose sight of the fact that the minor details of dispensing must be explained to the student as he progresses with his study. The course definitely should not be made a labor saving service, any more than the clinical service contributed by a medical or dental student. This very definitely indicates that the student must be shifted from one type of service to the other if he is to gain any portion of the objectives which have been outlined.

Hospital Dispensing — Lecture

1. **Operation principles of the pharmacy**
   - **Business methods**
   - **Pharmaceutical**

2. **Pharmacists' responsibility**
   - **Professional**
   - **Institutional**
   - **Legal (Legend drugs—narcotics—alcohol)**

3. **Formulary**
   - **Purpose**
   - **Compilation**

4. **Prescription nomenclature**

5. **Introduction to specialized medical terminology**

6. **Introduction to hospital, medical, and other specialized literature**

7. **Types of hospitals**

8. **Internal hospital organization**

   Hospital pharmacy's position

9. **Prescription specialties**

   Correlation with official analogs
   Logical method for presentation

10. **Special problems—Hospital Dispensing**

    Sterilization
    Packaging
    Dosage forms, etc.

11. **Clinical visitations**

    Wards and clinics within the hospital
    Other type hospitals

Hospital Dispensing — Laboratory

1. Orientation

2. General Instructions

   Personal appearance and attire
   Personal hygiene
   Deportment
   Punctuality

3. Hospital pharmacy policy

4. Initial dispensing of bulk and routine ward drug orders

   Dispensing methods
   Labeling
   Packaging, etc.

5. **Introduction to special procedures and calculations**
   - **Formula variations**
   - **Alcohol readjustment**
   - **Special dosage forms**
   - **Antibiotic preparations**
   - **Parenteral preparations**
   - **Miscellaneous-technical formulations, etc.**

6. **Instruction in prescription dispensing procedures**
   - **Call slips**
   - **Prescription-filing, etc.**

7. **Assignment to individual prescription unit**

8. **Methods of prescription evaluation**
   - **Classification**
   - **Incompatibilities**
   - **Dosage form and amount**
   - **Pricing**

9. **Patient relations**
   - **Outpatient**
   - **Student health**

10. **Introduction to interprofessional relations**

One of the most difficult problems associated with in-service training in a hospital pharmacy is the scheduling of hours. It is highly desirable that the student be on duty in the pharmacy for periods of not less than two hours and it is also most important that the student serve some time covering the complete daily period of operation of the pharmacy. We believe that from 80 to 105 hours are necessary if the student is to acquire any proficiency in dispensing techniques and institutional operations. We have found it convenient to arrange the laboratory hours by grouping our students and giving them their orientation and instruction in groups rather than to take the entire class, which of course, would make it physically impossible to operate the pharmacy.

By grouping the students into dispensing teams, it is possible to have the individual groups overlap so that one group will be

charged with the routine dispensing work while the other is doing the actual prescription compounding and dispensing. There are periods of peak loads in a hospital pharmacy which vary according to the service which the pharmacy renders. For example, the dispensing of narcotics and alcohol, in a well-managed pharmacy, will be handled at a specific time. There are periods of excessive outpatient prescriptions. Again, if the student health department is being served there may be periods between classes when the pharmacy is extremely busy. Since the prescriptions for outpatients and ambulatory patients are of the general nature of medication for minor illnesses, they differ somewhat from those furnished to the bed patients. Further, it is desirable that the student become acclimated to working under pressure. I wish to emphasize that at no time is an unregistered person permitted to dispense medication without the checking of a full-time registered pharmacist.

The matter of grading a student in a course of this type is not unlike the grading of the student in the prescription laboratory. Each of us will perhaps modify the basis for grades but as a nucleus for discussion I would like to present the following points as a basis for computing the student's grade in the course.

Student graded on:

1. **Punctuality**
2. **Ability to apply pharmaceutical principles**
3. **Professional attitude and aptitude**
4. **Manual dexterity**
5. **Academic performance**
   Written examinations and oral quizzes

In closing I would like to add that it is my opinion that the student must do actual dispensing. He should be given every opportunity to perform the pharmaceutical operations of the pharmacy. Only through experience will he become proficient and competent.

Pharmaceutical Manufacturing

(Abstract)

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I think that this term, "manufacturing pharmacy," means to most of us a course which is designed primarily to teach the student the conversion of formulas, the use of a few machines, a smattering of techniques, and perhaps some phases of quality control. To me, this is not manufacturing pharmacy, or industrial pharmacy, as I prefer to call it. In practically all pharmaceutical plants, such jobs are performed by office clerks or hourly-wage workers. This is very clear cut in plants which are unionized, and I trust that we are not educating our students to become members of labor unions. Please don't misinterpret this remark. I am in no way opposed to organized labor. I have dealt amicably and peaceably with it for many years, and frankly, I am in favor of it. My point is simply this. We hold out to the student in retail pharmacy the possibility of managing or owning a store. Why, then, in training the student for industrial pharmacy, shouldn't we hold forth the possibility of a key executive position, or the ownership or part ownership of a manufacturing company? Why train them, and only partially train them, for jobs which pay anywhere from $1.00 to $1.75 an hour under the current wage rates in the industry? In doing this, we give the student a false impression as to what industrial pharmacy actually involves. With such training and plenty of experience, the pharmacist may become a department head or supervisor at $400 or $500 per month, but to go into the higher brackets where he belongs, he must have something else—either by nature or by training.

Industrial pharmacy, it seems to me, must be taught in such a fashion as to include all phases of plant management and opera-

tion as we know it in the pharmaceutical manufacturing industry, and the graduate must also have a good understanding of the problems before the sales and research divisions in order that he may better appreciate the necessary and proper coordination between all divisions. This does not mean that the graduate from a five-year course in industrial pharmacy is going to step into a job as works manager. There is still no substitute for experience, and he will have to climb the long ladder. But he will have the wherewithal to climb it without stopping on the fourth or fifth rung.

I should like to be specific about the methods we have set up for teaching two particular parts of industrial pharmacy, laboratory work and that part of production control known as production planning.

We regard the laboratory purely as a means of teaching the student product development work, in-plant control, the application of statistical quality control, and industrial engineering methods. In the great majority of manufactured items, the non-specialties particularly, or common run of pharmaceuticals and proprietaries, the major part of the cost is in the packaging. The only approach to cutting costs in this field is just plain smart engineering. Consequently, industrial engineering methods are of paramount importance in the laboratory. The uses, advantages and disadvantages, set up, and maintenance of machines are incidental.

After thorough explanation and demonstration of a particular type of preparation, the student applies his knowledge to a few examples in which all factors are known. He is given complete working formulas with full instructions and precautions. Finally, he is given the assignment of developing a preparation having certain specifications. This, in reality, is the examination on his training thus far. He must work out his own formula, the manufacturing procedure, the precautions to be observed, and, finally, come up with a product which meets specifications. Following this he will have at his disposal certain factual data and specifi-

cations regarding packaging materials. From these, the student must determine the best types of containers and closures for his particular product. This is usually simple in the cases of tablets and powders, but it is almost certain to give him trouble when he is dealing with many kinds of liquid preparations and ointments. Finally, after studying the product and its effect on the packaging materials under accelerated storage conditions, he has the job of writing up the packaging specifications.

Methods Used in Assay and Control

(Abstract)

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An assumption is made that this course is to be presented in the senior year of the pharmacy curriculum. The problem confronting any teacher is one of course content. The types of control needed to put a drug on the market involves the following:

"Drug Research and Development by Smith and Herrick". (1) The manufacturing order; (2) Factory control; (3) Inspection at the production center; (4) Samples for inspection and approval; (5) Laboratory control; (6) The bioassay laboratory; (7) Microbioassay of dietary supplements; (8) Checks on stock of ingredients and finished material; (9) Control of packaging material; (10) Control of labeling material; (11) Control of label copy; and (12) Plant sanitation in general.

The course content was divided into six fields of control:

(1) Pharmaceutical Elegance; (2) Physical Constants; (3) Biological methods; (4) Chemical methods; (5) Physio-chemical methods; and (6) Phytochemical methods. The subject matter was then outlined under each of these headings.

The objectives for the course were stated as follows:

This course was designed for students of pharmacy. It is based upon the idea that the pharmacist should possess certain skills and knowledge, including

a. An understanding of the value and importance of methods of assay and control in the dispensing of medicines.

b. An understanding of the technics and methods used in pharmaceutical and chemical control laboratories.

c. An understanding of the values and purposes of the pharmaceutical standards and assays of the United States Pharmacopoeia and other compendiums.

d. An understanding of the values of control procedures in the development of a new drug.

The following analysis of this course into more or less specific objectives has been made to show the relationship of the many phases of the course to these general purposes.

Classified List of Objectives

I. Information. (The student must have a substantial foundation of factual knowledge, either from practical experience or in the introductory parts of the course before he can make any real progress.)

(a) Vocabulary and definitions

(b) Specific facts

(c) General laws and principles

(d) Technological processes

(e) Historical background

II. Reasoning or Scientific Method

(a) Apply the principles and reactions involved to the quantitative determination of the constituents on any unknown.

(b) Apply the principles to the solution of problems of analytical procedures.

(c) Apply the principles to the development of new methods of assay and control.

III. Location of Relevant Data

(a) Original Sources "Journals Devoted to Specific Fields"

(b) Secondary Sources

a. Periodicals
b. General references for tabular data
c. General treatises
d. Official methods
e. Textbooks

IV. Skills

(a) Manipulative dexterity in using control apparatus.

(b) Skills in interpretation and application of theoretical principles.

V. Standards of Technical Performance

(a) The satisfactory completion of representative known and unknown samples.

(b) The ability to apply methods learned in simple determinations when assaying mixtures.

(c) The ability to apply methods and principles learned in this course to general control procedures.

VI. Reports

(a) Laboratory reports

b) Problems solved

(c) Special technic reports

(d) Reports on inspection trips or visual material

VII. Social Mindedness and Personal Characteristics

(a) The development of desirable traits of character

VIII. Appreciation

(a) Commercial Values

1. Manufacturing (control)
2. Purchasing (according to assay)
3. Selling (according to assay)
4. Using (according to purity)
5. Research

(b) Social Values

1. Legal protection

a. Foods
b. Drugs and pharmaceutical products
c. Air
d. Water
e. Sewage

The method of accomplishing the objectives stated above is left to the individual instructor.

The testing program for a course of this type can best be done by means of general examinations and use of unknown samples for checking and control. Examinations may be of several kinds:

(1) The essay type, (2) Multiple choice, (3) Matching questions, (4) Objective true and false, (5) Questions involving mathematics, (6) Laboratory testing on unknown, and many others. A good instructor will work out his own methods of determining whether his studens are getting the course content.

Laboratory Control

(Abstract)

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In times past, the "analytical laboratory" has been referred to as the agency in a drug manufacturing concern that was responsible for the quality of goods sold. Later the term "control

laboratory" came into common usage, but simultaneously other types of "control" were introduced into the administrative affairs and the manufacturing processes of the plant, so it became necessary to indicate the type of control under consideration. Essentially, in plant operation we have two main types of control, namely, production control and quality control. In this paper interest is centered in the latter type. Broadly speaking, however, the term quality control may be applied to every function which contributes to the production of goods of the right quality.

There is one fundamental fact that must always be kept in mind, namely, that ***quality must be built into the product; quality cannot be inspected into it.*** Consequently, the control of quality of manufactured pharmaceuticals must begin with the first step taken in manufacturing—the setting up of specifications for raw materials—and continue to the *last* operation, i.e., shipping the goods to the customer.

To train students to become capable control men, it is not sufficient to make them expert analysts. They must be capable of handling all kinds of control functions. First and foremost, the student should have had training in pharmacy. These are the courses listed in the standard pharmaceutical curriculum. But there are courses not usually found there which must be stressed, such as courses in instrumentation, quality control systems; physical chemistry and advanced organic; statistics, and drug deterioration.

In the standard colleges, for example, it seems that no formal course is given in the last named subject, yet drug deterioration is one of the most serious and perplexing problems with which the product development pharmacist and the control people have to deal. The problem is to find the cause or causes of deterioration and eliminate them or find means of stabilizing and preparation.

A course in quality control systems would necessarily be similar to instruction in production planning and scheduling. A course

in industrial pharmacy may be simply a survey course on pharmaceutical plant management and operation with laboratory work designed primarily to bring out difficulties in manufacturing and packaging operations.

Statistical methods are of particular value in setting up sampling plans, weight and full control, determining the validity of assay methods and the differences between analysts on the same method or between operators on the same job in the plant and locating favorable or unfavorable factors in chemical processes or other operations in the plant, and a host of other things. The industry is a most fertile field for the application of statistical methods and we can do a great service to both students and industry by training students well in this field.

Manufacturing for Hospital Pharmacy

(Abstract)

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Among the courses of value to the student who intends to enter hospital pharmacy is manufacturing pharmacy.

To properly teach a course in pharmaceutical manufacturing, which is specifically pointed to hospital pharmacy, requires a good deal of equipment and competent teaching personnel. With this thought in mind it would seem logical to limit such teaching to schools that are already equipped to do this job, or to schools sufficiently interested and financially endowed to proceed with such

a program. It is obvious that the enrollment in the course would have to be limited and that the cost of instruction per student would be high.

A course in manufacturing for hospital pharmacy must be of sufficient scope to include hospitals of all sizes. However, it is a function of prime importance for the instructor to point out the extent to which a hospital of a specific size should enter the manufacturing field. The important factor governing the scope of manufacturing activity is the financial saving to the hospital compared to commercially available products. However, the research services which such a laboratory affords the medical staff cannot be over emphasized.

The pharmacist who is specifically trained in hospital pharmacy, including manufacturing, could not be expected to spend the majority of his time in a manufacturing laboratory. His function would be to supervise the manufacturing laboratory and to train personnel in manufacturing techniques.

The objection frequently raised to manufacturing in a hospital pharmacy is the maintaining of quality and control of the finished product. The large pharmaceutical manufacturer has an elaborate system of control intended to standardize products and to minimize errors. A hospital could not hope to set up all the control systems that a commercial manufacturer uses. To compensate for this seeming lack of control, the hospital manufacturer must have an adequate check on ingredients as they are added to a formula. Not only must the identity of the drug be checked by a careful reading of the label, but the weight or measure must be carefully checked. This type of production control requires that two people work in cooperation in the laboratory.

In my opinion, it is not a profitable procedure for most hospital pharmacies to do quantitative analysis of finished products. This will of necessity eliminate products of a highly potent nature

from the manufacturing list. Proper production control, however, will make it profitable to manufacture items of a less potent nature.

From observation and experience, it would appear that ointments, syrups, elixirs, gels suspensions and related products could be readily manufactured in a hospital provided with competent pharmaceutical trained personnel. The financial saving on many of these products is very worth while.

The manufacture of parenteral fluids must be carefully considered before an attempt is made to prepare them in a hospital. At the Universty of Illinois we have just completed a study of such solutions for sterility, pyrogens, and storage. The conclusion reached was that parenteral solutions can be successfully prepared with a minimum of equipment if cleanliness and careful procedures are followed. Spot checks for sterility and pyrogens should be carried out, but testing of every batch is not absolutely necessary. The saving to a hospital can be very gratifying. Over a period of three years, the University of Illinois Hospitals have not had a single patient reaction which could be traced to Pharmacy prepared parenteral fluids.

Compressed tablet manufacturing and tablet coating should as a rule, be restricted to large hospitals where consumption of such products is great and the investment in expensive machinery warranted.

May I emphasize again that to train pharmacists for hospital manufacturing necessitates teaching a complete course, including manufacture of all the dosage-forms in common use. The well trained man must be able to cope with the situation as it presents itself.

The following outline will serve to illustrate the material being taught in a typical manufacturing course directed specifically toward Hospital Pharmacy:

A. Scope of Manufacturing in various size hospitals.

B. Discussion of Manufacturing Control, including Master Formulas, Work Sheets, Production Records, Stock Control, and Product Stability.

C. Manufacture of Compressed Tablets.

D. Tablet Coating.

E. Preparation of Galenicals, including Elixirs, Syrups, Magmas, Gels, Jellies, Lotions, and Solutions.

F. Preparation of Ointments and Suppositories.

G. Parenteral and Special Solutions.

The laboratory work consists of actual experience manufacturing in a hospital pharmacy. The student is required to spend sufficient time in each department, such as tablets, parenterals, liquids and ointments to familiarize himself with the manufacturing process involved.

Such a course should consist of at least 72 laboratory hours and 24 lecture hours.

The Concept of the History of Pharmacy

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The scope of the history of pharmacy can be defined by examining what substantially belongs to pharmacy and by stating where the boundaries have to be drawn between the related sciences and professions. Its definition may, to some extent, be made the subject of an agreement.

With the concept of the history of pharmacy, it is quite different. Being not of a substantial but of an ideological nature, it means to the substance of the history of pharmacy what the soul means to the body, i.e., its enlivening and humanizing. The drawing of boundaries, as important as it is to the definition of the scope, has no decisive bearing upon the concept of the history of pharmacy. This concept, representing the essence of the history of pharmacy as well as its elixir of life, cannot be made an object of an agreement. It is determined by the answer to the question, *What does pharmaceutico-historical knowledge mean to the pharmacist and to the tasks assigned to him?* Or, in other words, *What is it good for?*

In 1936, Charles O. Lee read an excellent paper before the Section on Historical Pharmacy of the American Pharmaceutical Association. (Dallas Meeting), with the significant title, "Discovering Pharmacy Through History." In this paper, the author pointed out:

"We need, first of all, to become thoroughly professionally minded. This will be accomplished, in part at least, by becoming imbued with the idea that the lessons of pharmaceutical history and its traditions are of value. With a true historical picture of our profession at hand, we should be able to go forward with intelligence, interest, and enthusiasm. In almost any field of research today, the worker is expected to know, or at least find out, what is known and published upon the subject of his study. This principle is quite as applicable to professional understanding and progress. If we have not made adequate progress, it is quite likely that we can charge it to unscientific methods of approach."

The awakening and fostering of "intelligence, interest, and enthusiasm" and consequently the employment of scientific or, as I would prefer to call it, systematic methods in approaching the problems of the profession,—it can scarcely be expressed more precisely and more clearly what pharmaceutico-historical knowledge means to the pharmacist and to the tasks assigned to him.

I may be permitted to be somewhat more explicit. There is scarcely another profession in existence connected,

or to be brought into connection, with so many other human activities as pharmacy. Its basic sciences form the ground work, but through the entire life of the profession, the principles of economics have been of no small importance. Law and legislation, the fine arts, the classics, languages, literature, general history, philosophy, all of them have been applied to pharmacy, have played a more or less important part in the sciences or in the practice of the profession.

So much has been said about the inspirational tasks of the history of pharmacy. They are doubtless great, and whenever the teacher of the history of pharmacy is inspired as he should be, he will inspire his students. Nevertheless, I was glad that Lee, in enumerating the three main results he is expecting from pharmaceutico-historical knowledge, placed intelligence and interest before enthusiasm. I would even say that, as far as teaching is concerned, the order of sequence should be interest, intelligence, and enthusiasm.

First the teacher has to dig the students out of their indifference and make them interested. Then they have to collaborate intelligently and if, as a result, the teacher gets the students enthusiastic, then a big victory is won for the teacher, for the student, and, finally, for pharmacy at large and for the fulfillment of place is more in the organized representation of pharmacy before

To go more into the details. It is not the task of the instruction in history of pharmacy to offer complete courses in economics, the fine arts, the classics, etc. However, this instruction has doubtless to explain the most important terms of classical derivation used in pharmacy in tracing their origin, to picture the development that led to price cutting on the one hand and to the cooperative movement on the other, to exemplify the part art played in pharmacy and pharmacy took in art as well as in literature, to show how general history has influenced the development of the

profession, to point out how legislative regulation of pharmacy came about and how it has differed under different political conditions and was changed in changing situations, to give an intimation of the relations between philosophical concepts and medical theories.

In doing that and doing it intelligently, the teacher of the history of pharmacy has opened for his students the main entrances to the edifice of general culture. Moreover, he has made it clear to them that they have a legitimate claim at one wing of this edifice. The lesson pharmacists have to learn and, if they really have got it, will never forget in their life, is that it is within their profession and using the latter as a vantage ground that they can affiliate with the army of cultured people forming the intellectual elite of the world.

In the "Basic Material for a Pharmaceutical Curriculum," the author says:

"Every college student—irrespective of vocation—can demand as his right the training necessary to make him a 'cultured' man. But the task of determining just what should be the content of this extra-vocational curriculum is itself a major problem and one much more complex than is the determination of the vocational curriculum. It is an independent study which when completed from the functional point of view may be incorporated without material modification into the curriculum of each professional school."*

I agree with the statement that every college student can demand as his right the training necessary to make him a "cultured" man. I disagree, as far as pharmacy is concerned, with the assertion that this training must be regarded and created as an "extra-vocational" one.

*Basic Material for a Pharmaceutical Curriculum prepared under the direction of W. W. Charters, A. B. Lemon, Leo M. Monell, N. Y. 1927.

It has to be said with all possible clearness and definiteness that the concept of the history of pharmacy being a cultural and humanitarian one, it is the goal of the instruction in history of pharmacy to make the pharmacist a citizen of the world of culture, a "cultured" man on the basis and for the sake of his profession and finally of mankind.

When the four year course in pharmacy became the legally recognized basis for graduating in pharmacy with the bachelor's degree, the authorities concerned asked for the introduction of "cultural" disciplines into the curriculum of the colleges. The New York Board of Education insisted upon a course in the History of Civilization. A course in the History of Pharmacy has not been required and would not have been regarded as of the same "cultural" value, hence as an adequate substitute for that in the History of Civilization. It seems to me that here is a task to fulfil on the part of the American Association of Colleges of Pharmacy.

In the "Findings and Recommendations of The Pharmaceutical Survey 1948" (page 6) under the significant heading "Key Problems of Pharmacy" the following has been stated:

"Throughout The Survey . . . it has been assumed that there is a **'profession'** of pharmacy . . . As professionals, pharmacists are obligated voluntarily to accept and observe the codes for technical performance and individual conduct developed through the years . . .

"Professional standards are under the influence of their commercial environment. From this influence have come the five key problems for the survival of Pharmacy as a fine profession—the problems of education, of economics, of ethics, of collective self-government, and of the relations to the health professions.

"After all has been said and done, it may be concluded that the outstanding factor determining the future of the profession of pharmacy is fundamentally moral in nature. The profession must contain a far greater proportion of members who are ever sharply jealous of the high reputation of the profession and who, by energetic cooperation, are determined ever to protect that reputation."

There cannot be any better general confirmation of the im-

portance of the ideological concepts of and in pharmacy . It simultaneously implies the recognition of the necessity to convey to the pharmacists the knowledge of the facts and responsibilities they are supposed to be proud of, that means the history of pharmacy.

History cannot be learned merely by memorizing facts. It must be perceived. The individual facts gain their meaning and importance from the general context in which they are standing and by which they are bound together as products of and as factors within the general development. That means that the student of the history of pharmacy becomes of necessity so interested in society and the part of his profession in the life of the community and the commonwealth at large, that he finally becomes ambitious in the promotion of this part, its demonstration and recognition.

It has been said before that the goal of teaching history of pharmacy is the education of the students to become citizens of the world of culture. That includes the education to be good citizens of the communities and the nation. You cannot recognize general principles and ideas as obligating rules without employing them in your immediate sphere of life.

Thus the way has passed from the awakening of interest to the sharpening and employment of intelligence as a result of the study of the history of pharmacy. And enthusiasm, this most sublime and most activating factor in life, in getting and keeping things done and men moving. Enthusiasm, kindled by some pathetic story or a melodramatic biographical sketch, does not last very long. Of course, these stories have to be told and such sketches have to be written. Like search lights they illuminate the facade of the building and they occupy the fancy of the public and arouse their sentiments. However, just for this reason, their place is more in the organized representation of pharmacy toward the public, in vocational and extra-vocational addresses, than in the teaching of history of pharmacy.

The *lasting* enthusiasm with which the student of the history of pharmacy has to be imbued, cannot be anything else but the result of his growing understanding of the history of the profession as a whole. If he really knows and intelligently evaluates the contributions of pharmacy to science and public welfare, the service which pharmacy means, the sacrifices it asks from its followers and the satisfaction which it is able to give, then his lasting enthusiasm is assured. The special inspirational value of biographies lies in the fact that the men concerned serve as models and as examples for the possibilities given in and by pharmacy. It is, however, not the one or the other person, not the one Scheele or the one procter, who can be taken and shown around again and again as the convincing witnesses for the intrinsic values of pharmacy. Single great individuals can be found, and in fact they emerge, everywhere. It is the continuity of great men coming from pharmacy which proves this our profession to be a particularly apt ground for the development of scientific talent and of the responsibility toward mankind that marks human greatness. It was for this reason that in the Kremers-Urdang "History of Pharmacy" the contributions of pharmacy to science and civilization have been described within the frame of a sketchy picture of the general development of the sciences concerned in their sequence of time as well as in their consequences for further research, and not within isolated biographical notes. In a somewhat more elaborate way the same has been done in the book "Pharmacy's Part in Society."

How can the sociologic contributions and responsibilities of the pharmacist be taught to the students so that their minds and hearts will be imbued with them?

That can and, as a matter of fact, has to be done during the general survey course whenever the opportunity offers itself, and in special courses of which the following are of particular value in just this respect:

1. **Pharmaceutical Ethics**
2. **Pharmacy in Art, Fiction, and Poetry**
3. **The Contributions of Pharmacy to Science and Civilization**

In the general course, it is occasional emphasis on the cultural or sociological implications which, if consistently applied, is more effective than is generally believed. As to the special courses, they have to be built up on the facts to be conveyed whereby the "inspiration" will be a natural result rather than an obvious purpose. To take "Pharmaceutical Ethics" as an example. The main phases are:

1. The aid of the sick as placed under divine protectorate, hence as a sacred duty of the priest.

2. The Oath of Hippocrates obligating those practicing the art of healing to the observation of special ethical rules, of which some were concerned with pharmaceutical activities.

3. The Law of Frederick II of the Two Sicilies of 1240 separating pharmacy from medicine.

4. The description of an ideal professional pharmacist in Saladin de Asculo's "Compendium Aromatariorum" about 1450 and its variation in the Dispensatorium Valerii Cordi and the Pharmacopeia of Jacques du Bois (Jacobus Sylvius) in the middle of the sixteenth century.

5. The oath sworn by the Parisian Apothecaries from the late 13th century on, which has come down to us in a 15th century modification.

6. The oaths sworn by German pharmacists in the sixteenth, seventeenth and eighteenth centuries.

7. The chapters concerning Apathecaries in the "Medical Ethics" published in 1803 by the English physician, Thomas Percival, and accepted by the English speaking medical world.

8. The ethical rules of the Philadelphia College of Pharmacy issued in 1848.

9. The ethical rules adopted by the American Pharmaceutical Association in 1852 and their fate.

10. The revival of the American Pharmaceutical Association Code of Ethics in 1922, and its later changes.

11. **The way in which pharmacy has been dealt with in the various modifications of the American Medical Association Code of Ethics.**

Needless to say, this enumeration only gives the frame. The general situation of the times in which the individual standards were set, and especially the relationship between the professions of pharmacy and medicine through the ages form an almost unexhaustible background for this course.

It is the fact that pharmacy touches and is touched by the entire environment in which it is practiced, that makes its history so rich and all embracing. We only have to know about it, and, as teachers, be able to convey our knowledge.

Teaching History of Pharmacy

GEORGE URDANG

University of Wisconsin

In all the older and even in the more recent fields of pharmacy which are subject to academic instruction, there has developed a kind of tradition offering a sort of guide which is helpful either in a positive or, if objected to, in a negative way.

That cannot be said of the history of pharmacy. Being recognized as an integral part of pharmaceutical education only a comparatively short time ago, there is no tradition of teaching, and not even any agreement as to the contents and the aims of the subject to be taught. The following is intended to promote discussion.

I. The Aims of Teaching History of Pharmacy

1. **To make the student familiar with the development of the profession to which he will devote his life.**
2. **To equip the student, on the ground of his own profession, for citizenship in the world of intellectual and moral responsibility.**

It is understood that the splitting up of these aims into two subdivisions does not mean that they have to, or even can be pursued separately. No adequate teaching of pharmaceutico-historical data is possible without the broader aspect of general intellectual and moral responsibility, and any attempt at conveying the latter without grounding it in pharmaceutico-historical facts would be preaching and not teaching.

II. The Contents of Teaching History of Pharmacy

The contents of the teaching of history of pharmacy can be generally characterized by the statement that it is concerned with supplying the people with drugs through the ages in all its branches and phases.

Concepts and factual data have to be investigated and presented.

III. Means to Achieve the Aims

The means of teaching history of pharmacy are the same as offer themselves in every other field of history teaching, i.e., survey courses, specialized courses devoted to individual phases or parts of the field, and seminars. The fundamental basis is, naturally, the survey course. While the specialized courses may be electives, and the seminars are the privilege as well as the task of advanced students, the survey course has to be required.

The purpose of this fundamental course is to give a general idea of the development of pharmacy from the very beginning of the use of drugs for combating and preventing disease up to our time. It is understood that this course has to emphasize the origin, development, and change of concepts primarily, and to stress highlights and stepping stones rather than details.

There is still some doubt in the minds of those responsible for pharmaceutical curricula and their practical application as to the

value for an American pharmacist of studies devoted to the history of pharmacy in antiquity and in the middle ages, in the main European countries in general and to international trends concerning pharmacy. The question comes up here and there whether it would not be sufficient and even better to offer a course in the history of American pharmacy only. It would be easy to answer this question by pointing to the undeniable fact that the time in which American isolationism was, or seemed to be, possible is definitely over, and that this holds true for every particular group likewise, especially if we asssume for their members, as professionalists, leadership in civil affairs. But to be more specific:

Without knowing of the connection between the supernatural and the art of healing in antiquity, and of the way in which rational medicine and pharmacy were born and practiced in ancient Greece, the student will not be able to see and intelligently evaluate the difference between rational and irrational therapy even in our time.

By being informed of the temporary loss of antique wisdom in the Europe of the Middle Ages, its partial preservation by the Arabs, and its return and revival in the period which is called the Renaissance, the student is introduced into the cultural development of the Western World on his own ground, and becomes aware of the continuous interrelationship between the general cultural development and that of the profession of pharmacy.

In surveying the highlights in the history of pharmacy in the great European countries, the student learns to discriminate between events, contributions, and situations of national and world-wide meaning, of separating and unifying tendencies. The latter become especially obvious in the discussion of the development of medical theories in their relationship to pharmacy, and of international trends reaching out into the field of the profession. Where else than in the history of pharmacy course can the student be given an idea of the importance to his profession of international

trends of a commercial nature (large scale manufacturing, patent laws, trade marks), of a social meaning (health insurance), and of trends lying within and representing professional pharmaceutical responsibility (supernational agreements with or without governmental sanction—e.g., unification of standards and of nomenclature, of pharmacopoeial drug monographs, and of narcotic laws), and of supernational associative cooperation.

It is only on this basis that the history of pharmacy in the United States of America can be taught successfully, i. e., with the result of an understanding of the cogency of the phases of development of pharmacy in this country and of its present day situation. These United States of America have been settled by Europeans of a rather high and stabilized culture which they tried to transfer to this, in every respect, New World.

Whatever has happened here since the days of Columbus has been, up to quite recently, a compromise between this attempt at transference of European concepts, knowledge, and methods, and the requirements of a pioneer situation. Which were the patterns followed? To what extent and in what way were they modified? Who were the men who, at one time or another, initiated or marked a new phase, and where did they and/or their ideas come from? This is the history of American civilization in general, and it is its application to the development of American pharmacy which our students have a right to expect of their teachers in the history of pharmacy.

The purpose of this paper is to offer what its author thinks to be the general fundamentals of the history of pharmacy and its teaching in a survey course in the American schools of pharmacy. Although based on a lifelong experience, it is the opinion of one individual and open to discussion. The following topics should be discussed:

1. The aims of teaching of pharmacy
2. The contents of teaching history of pharmacy
3. The advisability of a required survey course
4. The contents of the survey course

This general discussion could be followed by another one devoted to special questions:

1. At what stage of his study shall the student be exposed to the course?
2. How many hours weekly shall be devoted to it?
3. Shall it be given in one semester, or in two subsequent ones?
4. The manner of presentation

There may be many more questions. This is the time and place to discuss all of them in all frankness and with all the sincerity that the topic requires, because of our grave responsibility towards the young men and women entrusted to us.

Specialized Courses in History of Pharmacy

GEORGE URDANG

University of Wisconsin

The idea of specialized courses on particular phases or parts of the history of pharmacy is supposed to result from the consideration that these phases or parts have a kind of intrinsic logic or continuity or importance which cannot be taken care of sufficiently within the frame of a survey course. This certainly holds true for topics like "Important Men in Pharmacy" or "The History of Pharmacopoeias." As a matter of fact, there is no end of topics which could be dealt with more in detail and with more

specific attention to the particular conditions of and reasons for the way in which their development took place. The decision as to whether or not such special courses are to be given depends to some extent on the time and personnel alloted to the teaching of history of pharmacy. It depends furthermore on the personal inclination and preferences of the respective teacher.

Whatever topic, however, is chosen, the specialized course will mean more than a chronologically arranged mass of factual data, events, and men only if there is a leading general idea conceived and conveyed. To exemplify this statement in the two topics mentioned above:

If the course "Important Men in Pharmacy" offers nothing but a series of disconnected biographical sketches, it might arouse human interest in the individuals portrayed and be impressive and even touching. It will attain a real historical meaning and value, however, only if these important men are grouped into categories and periods of time. It is not sufficient, for instance, to present a biographical study of the famous seventeenth century pharmacist Lemery. We have to draw a picture of pharmacy as the mother of scientific chemistry in the seventeenth century, and then to define and determine the place which the prominent pharmacists of this time—not only Lemery, but also Glaser, Lefebre, and Charas —occupied within this development, giving every one of them special attention, but nevertheless dealing with them as a group. Why were all of them Frenchmen, or at least working in France? Why did the trio, Lefebre, Charas, and Lemery emigrate to England and later return to France? Why were the famous seventeenth century pharmacists in other countries, Pieter Coudenberg in Holland, Renward Cysat in Switzerland, and Basilius Besler in Germany (Nuremberg), botanists rather than chemists?

Coming to the eighteenth century, a galaxy of French pharmacists-chemists were joined by a similar group of Germans. In Sweden, there was not only Scheele but also Retzius. Pharmacists

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Coming to the eighteenth century, a galaxy of French pharmacists-chemists were joined by a similar group of Germans. In Sweden, there was not only Scheele but also Retzius. Pharmacists

became university teachers of chemistry as well as authors of textbooks. Again, not only the "whats" but the "whys" have to be presented, as well as the general development and the individuals shown in their interdependence.

As to the important men in American pharmacy, the same principle of grouping has to be observed. William Procter, Jr., Edward Parrish, and John M. Maisch, for instance, would form one such group. Squibb and John Uri Lloyd another; and Remmington, La Wall, and Arny a third one; and so forth up to Prescott, Powers, Kremers, and Wulling; and, finally, up to our contemporary leaders in the sciences and politics of the professions.

The history of pharmacopoeias has its general idea in the mirroring of the adoption of progress in the sciences concerned by the authorities responsible for the official books. What was the situation before the introduction of obligatory pharmaceutical books of standardized formulas? What were the reasons for their creation? What is the definition of an "official" pharmacopoeia? Were there different kinds of pharmacopoeias and how were they characterized? Did political events influence the time and kind of issuance of pharmacopoeias?

Following the chronological sequence of the issuance of the most important pharmacopeias, their arrangement, the kind of simple and compounded drugs and every important change, deletion, or admission has to be noticed and explained. When did the movement of deleting drugs based on fanciful concepts rather than on rational consideration start? Which countries were, in this respect, conservative, and which were progressive? When were chemicals for internal use first introduced in an official pharmacopoeia? When and where was the new chemical nomenclature and Linne's binominal botanical one adopted for the first time? What has been the part of pharmacists in the preparation of the pharmacopoeias throughout the ages?

As to the United States Pharmacopoeia, the precursors and their history have to be presented, and the reasons for the failure of the early promoters of a national North American Pharmaceutical standard explained. The dramatic story of the schism lead-

ing to the two pharmacopoeias of 1830 and 1831 has to be told in detail and with its personal and regional peculiarities. How did pharmaceutical cooperation in the revision work develop? When and why did pharmacy take over the responsibility for the maintenance of the book? Here again a dramatic story has to be told with Squibb, Frederick Hoffman, and Charles Rice as the main actors, but with the indifference towards drug therapy on the part of official medicine of this period as the determining background.

Which European patterns were followed and why? The change of language of the U.S.P. up to the present day has to be shown and explained. The gradual change has to be shown from the apothecary weight to the metric system, from Fahrenheit to Celsius, from formulas for manufacturing compound drugs to standards for identification and examination. The elimination of old and the introduction of new classes has to be discussed. The development from a little recognized book prepared by a small group of physicians to a standard which, under the responsibility of pharmacy and with the help of every conceivable group of experts, is not only following, but partly even leading progress, has to be made clear to the student in its full meaning. In doing so, we have met the general idea mentioned above. We simultaneously have conveyed the idea of pharmacy as the guardian of the most adequate and most progressive drug armamentarium, hence as an important cog in the machinery of modern society.

Finally there should be discussed the attempts at umbreation of all pharmacopoeias of the western world lending to the creation of a Pharmacopoeia Internationalis.

Specialized courses cannot replace the general survey course. The latter has to be the fundamental basis. Now and again within a specialized course, the teacher will have to refer to some event or individual mentioned or statement made in the general course. But although they cannot be substituted for a general survey course, specialized courses can supplement it beautifully. They should be selected with care, and prepared with the idea of the close inter-relationship between all phases of the history of the profession of pharmacy which, after all, is a whole.

Some Teaching Aids in History of Pharmacy

(Summary of a Discussion)

GLENN SONNEDECKER

University of Wisconsin

The broad field of history and the complex subject of pharmacy represent a combination that continually challenges the professional historian. But most of those who teach history of pharmacy, now or in the immediate future, do so without much formal preparation and as a side-line. Under such circumstances, it was believed that the two teaching aids here presented might be of some usefulness: first, a set of slides to supplement lecture material on the development of American pharmaceutical associations and schools; and, secondly, a discriminating list of sources in English for supplemental reading by the teacher.

With regard to visual material, it is hoped that—should there be sufficient demand—this set of illustrations will be only the first of a series for teachers of history of pharmacy. The question naturally arises: What would be the best form of visual material for general distribution? Here at Wisconsin our entire file of projection material is in the form of 3¼- by 4-inch slides. This may be largely a matter of custom, but it also seems to have practical advantages. Perhaps the main advantage over film strip is flexibility, which permits selection and rearrangement of slides for different courses, for special lectures to lay or professional groups and for the purpose of adding illustrations as new material becomes available. Moreover the 3¼- by 4-inch slide provides better definition in projection than film strips when reproduction must be from old prints or other historical material in poor condition. On the other hand it probably would be generally agreed that film strips permit more effective presentation. As

near as can be determined film strips could be made available to other schools at a price the same as or lower than that for slides if there should be demand for about fifteen sets. (At the Teacher's Seminar, however, a show of hands indicated that only two of those present preferred to have material supplied as film strips.)

How far should our ambitions go toward supplementing or replacing lecture materials with visual material in history of pharmacy? Some have suggested very extensive use of this technique. This question has been explored with Dr. Urdang in some detail, and we believe that just in this field such an excellent teaching tool could easily be pushed too far. The instruction time usually available does not permit much entertainment at the expense of illumination. When it is most meaningful, history is largely the development of ideas and trends—and a vehicle for imparting ideas to and stimulating ideas in the student—not a rehashing of isolated facts and dates. Such material often does not lend itself readily to visual illustration. And when it does, we are often severely limited in the pertinent historical illustrations that have come down to us. If the historian pursues too ardently the visual technique his presentation may seem—at least to his students—merely a matter of men *with* beards and men *without* beards.

Certain phases of pharmaceutical history obviously lend themselves more readily than others to significant visual treatment: pharmaceutical biography, development of industry, evolution of pharmaceutical techniques, pharmaceutical literature, the arts in pharmacy, etc. Here we shall recall only a few among the readily available sources of illustrative material: Wimmer's "The College of Pharmacy of the City of New York" and "The First Century of the Philadelphia College of Pharmacy" are especially useful in American history; Hermann Peters' "Pictorial History of Ancient Pharmacy" and Ferchl and Sussenguth's "Pictorial History of Chemistry" bring together many classic illustrations; for ceramic art in pharmacy, the catalog of "The Squibb Ancient Pharmacy" is excellent.

The effectiveness of the visual technique in history of pharmacy is vastly increased if we exploit the possibilities of historical maps, graphs, charts and pictograms. These are well adapted to help the student grasp and retain general trends and concepts, such as the rise and fall of types of medication; geographic variation in the number of pharmacies and pharmacists in relation to populations; prescribing trends; spread of government health insurance through the world (sequence maps); medical theories like the humoral pathology, etc.

Other examples are the slides (in the set shown and commented upon at the Teachers' Seminar) depicting: (1) by map, the number, location and relation between local associations and places of pharmaceutical instruction by the time of the Civil War, (2) by graph, the growth of present schools and, by map, their location and (3) by graph, the growth of legal regulation in relation to the establishment by state pharmaceutical associations.

The School of Pharmacy at the University of Wisconsin, in collaboration with the American Institute of the History of Pharmacy, would be glad to serve as a clearing house for such material developed at other institutions, which could be distributed in duplicate at a cost price. I hope that anyone who develops such material may accept this suggestion and thus make a contribution to more effective teaching in our field.

Order Form

To: Photographic Laboratory
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Attention: Miss Appleby

Please send lantern slides, as indicated below, on the development of associations and education in American pharmacy (set "A"), which have been made available by the University of Wisconsin School of Pharmacy (Department of History of Pharmacy).

We agree to accept the shipment by Railway Express collect and to return the shipping container.

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1. ☐ **Supply slides in the 3¼ by 4 inch size at 35 cents each.**

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2. ☐ **Send the complete set of 27 slides listed below.**

   ☐ **Send only those slides checked in the list below.**

(Numbers in parentheses are for negative identification.)

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..... 2. Daniel B. Smith (51,138-c)
..... 3. German Society Hall (51,-139-c)
..... 4. Pharmacognosy Room of 1878 at N. Y. College (51,-140-c)
..... 5. H. V. Arny (51,141-c)
..... 6. A. B. Prescott (51,142-c)
..... 7. F. R. Power (51,143-c)
..... 8. Pharmacy Laboratory of 1890 at Univ. Wis. (51,-144-c)
..... 9. Edward Kremers (51,145-c)
.....10. F. J. Wulling (51,146-c)
.....11. Wulling Hall (51,147-c)
.....12. Procter's "Practical Pharmacy," 1849 (51,148-c)
.....13. Edward Parrish (51,149-c)
.....14. Parrish's "Introduction to Practical Pharmacy," 1856 (51,150-c)
.....15. Map of associations and schools, 1865 (51,151-c)
.....16. Graph, growth of present schools (51,152-c)
.....17. J. P. Remington (51,153-c)
.....18. Remington's "Practice of Pharmacy," 1886 (51,154-c)
.....19. Oldberg's "A Course of Home Study," 1891 (51,-155-c)
.....20. Map, present schools of pharmacy (51,156-c)
.....21. Wm. Procter, Jr. (51,157-c)
.....22. Zane St. Building of PCP (51,158-c)
.....23. John Maisch (51,159-c)
.....24. C. Lewis Diehl (51,160-c)
.....25. Graph, growth of state associations and legal regulations (51,161-c)
.....26. T. V. Wooten (51,162-c)
.....27. A. Ph. A. headquarters building (51,163-c)

Turning now to the selected list of background readings as a second teaching aid, only brief comment seems necessary because of the annotations. It should be obvious that the list printed below omits many important works, not only in foreign languages but even in English. This stems from the given objective: to present, after consultation with authorities in the fields covered, a representative and concise list of publications that are reliable and easily consulted or read. However limited may be the clock

hours allotted to history, one cannot justifiably isolate pharmacy from the social, professional and scientific context of society within which its history is made. For that reason there has been a special effort to suggest a well-balanced list of pertinent publications in closely related fields.

The first section lists five historical atlases, each with its particular scope or purpose. They are included here from the conviction that geographic orientation deserves more attention than it often gets in special histories such as pharmacy. Historical atlases are suggestive of what could be done with pharmaceutical history maps and map sequences as a visual teaching aid. As John Smith of Virginia once put it: "For as geography without history seemeth a carkasse without motion, so history without geography wandreth as a vagrant without a certain habitation."

With regard to historical periodicals in medical and scientifc fields, the aim has been to make this second section comprehensive rather than selective. Papers of historical value also appear, of course, in such publications as the *American Journal of Pharmaceutical Education, Journal of the American Pharmaceutical Association,* and *Journal of Chemical Education.*

In the book section the annotations indicate the general scope and/or justification for each listing. It would be senseless to suggest that the "best" secondary book in each field has been listed, without knowing the objective of a particular reader. The aim has been, however, (1) to suggest volumes, from among those available in English, that are recognized as unusually well-done and reliable; (2) to cover not only history of pharmacy but also the interwoven fields of history of medicine, chemistry and science in general; (3) to provide, within the limits of high selectivity, background reading for the principal periods of pharmaceutico-medical history for those who must teach it as a side-line and who may not yet be prepared to select critically from the extensive literature.

Anyone not familiar with Sarton's "Introduction to the History of Science" (in five books) will want to become so forthwith, since it is an unexcelled reference work for special reading or research. In history of pharmacy as such, the bibliographies of the Kremers-Urdang volume are the most useful of those now in English. This then is the list, involving in spots both compromise and arbitrariness:

A Selected List of Sources in English for Teachers of History of Pharmacy, With Emphasis on Related Fields

Historical Atlases

Shepherd, William R., "Historical Atlas," Henry Holt and Co., New York, 1929. (A classic, covering ancient to modern times, but out of print.) Also Shepherd's "Atlas of Medieval and Modern History," Holt, N. Y. (Abridgment of preceding volume, focusing on modern European period; also out of print.)

Breasted, J. H., Huth, C. F., and Harding, S. B., "European History Atlas," Denoyer-Geppert Co., Chicago ,1947. (Helpful discussion of each of 58 maps plus insets; better for ancient world than Hammond atlas below.)

"Hammond's Historical Atlas," C. S. Hammond and Co., New York, 1948. (Inexpensive but less complete than Breasted; maps without text.)

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Graduate Work in History of Pharmacy

M.S. and Ph.D. in the History of Pharmacy

GEORGE URDANG

University of Wisconsin

It is understood that everyone doing graduate work in the history of pharmacy, with the aim of obtaining an advanced degree, has to comply with the general rules of the university concerning this type of work. To state briefly the requirements for every graduate student in whatever field at the University of Wisconsin:

1. The standard of work on the graduate level requires that a student receive grades of "B" or better in all of his courses.

2. The minimum requirement for the master's degree is one academic year of its equivalent in summer sessions. During this time the candidate must pursue a course of graduate study characterized by

definiteness of purpose and approved by his department. A thesis offered in partial fulfillment of the requirement must be approved by the major professor under whose guidance it has been done. The candidate must pass an examination upon the graduate work offered in support of his candidacy.

3. Candidacy for the degree of Doctor of Philosophy is based upon resident graduate study over a period of not less than three academic years, at least three semesters of which must be spent at the University of Wisconsin. In case of a doctorate with history of pharmacy as a major, residency at this university during the full period of not less than three academic years will be required of all students who have not done graduate work in the fields listed in the attached enumeration of courses.

Supplementary to his major study, a candidate is required to take a minimum of either ten or twelve credits in graduate courses in a field other than that of his major.

A reading knowledge of French and German is required of all candidates and has to be secured before the candidate is admitted to the preliminary examination to be taken not less than one academic year in advance of the date when the degree is expected to be conferred. Every candidate for the doctor's degree is subject to an oral examination upon the thesis and the general field of the major and minor studies. The thesis work has to be done under the immediate supervision of the major professor.

Scope of Course Work for Ph.D. in History of Pharmacy and Science

(The sequence and number of courses may be adjusted to individual programs.)

First Semester

Philosophy of Science (Philosophy Department)
Ancient History of Science (History of Science Department)
Survey of the History of Pharmacy (Pharmacy Department)

History and Geography of Diseases (Medical School)
(Background reading in sociology and philosophy if there is inadequate undergraduate preparation)

Second Semester

History of Pharmacopoeias (Pharmacy Department)
History of Medieval Science (History of Science Department)
Seminar in History of Medical Methodology (Medical School)
Social Interaction (Sociology Department)
Research (Pharmacy Department)

Summer Session

Capitalism and Socialism (Sociology Department)
Historical Method (History Department)
Social Stratification (Sociology Department)
Research (Pharmacy Department)

Third Semester

Proseminar in Early Modern Science (History of Science Department)
Proseminar in Modern Science (History of Science Department)
Social and Intellectual History of the United States (a) (History Department)
Medieval Civilization
Growth of Social Thought (Sociology Department)
The Part of Pharmacy in Society (Pharmacy Department)
Research (Pharmacy Department)

Fourth Semester

Survey of the History of Medicine (Medical School)
Social and Intellectual History of the United States (b) (History Department)
Seminar in Sociology of Knowledge (Sociology Department)
Survey of the History of Chemistry—Seminar—(Chemistry Department)

Problems in Pharmaceutical History—Seminar—(Pharmacy Department)

Research (Pharmacy Department)

Summer Session

Recent History of the United States (History Department)
Economic Theory (Economics Department)
Research Seminar (Pharmacy Department)
Non-credit Study: French, German, and Latin

Fifth and Sixth Semesters

Research (Pharmacy Department)

Minors: General History and Sociology

(The choice of the minors depends on the special inclination of the candidate. General History will be a must and may, in some cases, be regarded as sufficient. Sociology might be replaced by Philosophy or Economics, which naturally would require a change in the courses listed above.)

Minor in the History of Pharmacy

There is a possibility of taking a minor in the history of pharmacy while working for a Ph.D. degree in one of the other branches of Pharmaceutical science, e.g., pharmacognosy or pharmaceutical chemistry. It would require the minimum of twelve credits in graduate courses mentioned as minor requisites above.

The idea is to establish graduate courses in the development of pharmaceutical education as well as in the development of pharmaceutical industry as a valuable background for those graduate students who, after having obtained their degree in one of the pharmaceutical sciences, intend to go into teaching or into industry.

Outline of Assignments for History of Pharmacy

(Abstract)

CHARLES O. LEE

Purdue University

This outline is designed to acquaint the student first hand with the history and literature of pharmacy. No two students have the same assignments. In addition to being required to report briefly, in writing, a number of general readings from journals, each student is required to read a book which pertains to the history of pharmacy, medicine, or the related sciences. He is expected also to prepare a biography of some well known pharmacist of the past.

Perhaps the most worth while assignment is that of library research which requires that all of the titles on the history of pharmacy in any one year be listed. To do this it is necessary to submit the full titles, authors, and references, and at the end list the journals consulted. This leads the student to see all of the pharmacy journals and in leafing through them acquire an impression of the literature of pharmacy not otherwise gained.

All this requires work but with encouragement and guidance it has been found that most juniors and seniors can do it within the alloted time with profit and satisfaction.

The writer is aware that this approach to the subject of professional history is workable only where there are adequate libraries which are well staffed and convenient.

Recent Steps Toward Coordination and Improvement of Accrediting Procedures

Statement Relative To

Pharmaceutical Education

EDWARD C. ELLIOTT

Representing

AMERICAN COUNCIL ON PHARMACEUTICAL EDUCATION

I

The comments I am disposed to make this morning are, in the main the byproducts of personal experiences during a recently concluded nation-wide, intensive study of the educational system of the profession of pharmacy. Naturally these experiences were not uninfluenced by the preceding years of contact with other forms of professional education and their accrediting mechanisms and procedures. Fortunately the circumstances, personal and otherwise, permitted completely objective conclusions.

II

Four years ago the leaders of American Pharmacy initiated a comprehensive study of pharmaceutical education, practices and services. During the preceding twenty years there had developed an increasing awareness of the uncertain status of pharmacy as a recognized profession. This enterprise—*The Pharmaceutical Survey*—*was* carried out under the sponsorship of the American

*Memorandum. American Council on Education, Conference on Accreditation, Washington, D. C., Mayflower Hotel, November 13, 1939.

Council on Education, and with funds granted by the American Foundaton for Pharmaceutical Education. Fate decreed that I was to become responsible for the direction of the Survey which now has been completed and the results published.

From the beginning of the examination of modern pharmacy as a profession it was evident that the controlling factors for upgrading were centered in the Colleges and Schools of Pharmacy. These Colleges and Schools constituted the foundation of the professional structure. They had to be viewed not merely as individual regional institutions, but as a collective mechanism serving national purposes.

III

Notwithstanding the recognized lacks and faults, as now organized and implemented, it is my unbiased conclusion that pharmacy has made more progress for the improvement and unification of its professional education and training than any other of the professions. It is a further conclusion that this advancement is chiefly the result of the influence of the American Council on Pharmaceutical Education—the agency established for the accreditation of the professional schools. This Council represents the cooperative efforts of the profession for the conservation of the essential interest of the profession.

The Council was organized in 1932 and published its first set of standards for determining the acceptability of an institution for accreditation in 1937. After detailed personal examination by panels of the membership of the Council the first accredited list was issued January 1, 1940. This list contained fifty-four institutions. Eleven others were added during the next five years. Five newly established colleges are now in process of accreditation—a total of seventy.

IV

It should be noted that the American Council on Pharmaceutical Education consists of ten members, three representing

the American Association of Colleges of Pharmacy, three, the National Association of Boards of Pharmacy, three, the American Pharmaceutical Association, and, one, the American Council on Education. Thus the major professional groups actively participate in the making of the policies and the conduct of the operations of the Council.

The Council performs a two-fold function.

As is well known the licensure of individuals for the practice of pharmacy is controlled by the statutes and administrative regulations of each of the 48 states and the District of Columbia. The Council has gradually become the recognized national agency for setting the minimum educational and training standards for institutions qualifying individuals for admission to the profession. These standards constitute the basis for the reciprocal state recognition of licenses to practice.

The immediate administration of the procedures of reciprocity is under the National Association of Board of Pharmacy. At the same time the principle of reciprocity centers in the standards of professional preparation approved by the Council, in the form of the accredited institutions. Therefore, it can be seen that the Council serves in a distinctive quasi-legal capacity.

The Council performs a yet more important purpose—that of advising, stimulating, and assisting each of the professional training institutions in the raising of standards and the improving of the practices of the profession.

V

Among the major results of The Pharmaceutical Survey were a series of recommendations relative to the American Council on Pharmaceutical Education. In order to enable the Council more

effectively to fulfill its functions, for the continuous advancement of professional education and training, it was recommended that the Council be provided with a full time educational officer who would serve as the liaisson between the Council, the individual institutions, and the American Association of Colleges of Pharmacy. This officer has been established—the Director of Educational Relations. Through this director it is expected that the accrediting of institutions will represent something more than an intermittent slide rule evaluation. Rather, a genuine cooperative effort for the continuous educational improvement.

VI

My altogether inadequate preparation for this part of this Conference did not fail to consider the current criticisms of accrediting agencies. This was not difficult. In my pre-pharmacy years I had been a participant in certain of the controversies which have been going on during the past dozen years.

In particular, I have recently reviewed the six outstanding evils of accrediting agencies listed in 1938 by the "Joint Committee on Accrediting" of the National Association of the State Universities and the Association of Land Grant Colleges. These were:

1. **Too many accrediting agencies.**
2. **Their activities are destroying institutional rights and freedom, and they are assuming the power of governing boards.**
3. **Costs levied are excessive.**
4. **Too much duplication of agencies.**
5. **Standards are quantitative and superficial.**
6. **Outside groups dominate and refuse participation of educational groups in accreditation.**

Here it is not my business to act as counsel for the defense of all accrediting agencies. Here, however, it is my responsibility to enter a general denial that any of the evils just referred to may be charged to the American Council on Pharmaceutical Edu-

Council represents the internal power and aspirations of the profession of pharmacy. It is not something external to the fundamental interests and ideals of American higher education and professional training. It has been and will continue to be a vitalizing, constructive force for the betterment of pharmaceutical education and practice.

Last night I chanced upon a paragraph in one of Somerset Maugham's essays. "The relations between individuals and society are like a roulette table. Society is the banker. Individuals sometimes win and sometimes lose, but the banker wins always."

If one were permitted to moralize one might say not the banker (accrediting agency) but the individual (institution) must win from any system of accreditation if the system is to continue to exist.

The American Council on Pharmaceutical Education considers itself to be an ally of the institutions on its accredited list. It is not too proud to be criticised. It will cooperate wholeheartedly in any effort for the simplification, better coordination, clearer understanding and more economical operation of accrediting agencies. There is opportunity to smooth some of the wrinkles from the wisdom hitherto assumed by the theory of accreditation.

Antibiotics in Pharmaceutical Education

ROBERTSON PRATT AND JEAN DUFRENCY

University of California

Historically and traditionally, the pharmacist is the fountainhead of knowledge pertaining to drugs. The pharmacist more than any other member of the community is in a strategic position to disseminate information concerning drugs, since he contacts both the physician and the layman in a professional capacity.

With startling effulgence, new stars have recently appeared in the pharmacist's firmament. These new agents, the antibiotics, are destined to remain. The brilliance of their performance has been recorded many times and is unequivocally established.

Economic Importance of Antibiotics

The economic position of antibiotics in the pharmaceutical industry is perhaps best attested by the facts that the dollar value of sales of this small group of agents has been estimated to have exceeded one-half of pharmaceutical manufacturers' income from all synthetic medicinals in 1948. This position was achieved in less than five years: penicillin, the first antibiotic to be produced on an industrial scale, became available from commercial sources late in 1943. Not only domestically, but internationally as well, the antibiotics account for a large share of drug manufacturers' income. During 1948, the value of drug exports from the United States totalled 191 million dollars, approximately forty per cent of which was for purchase of antibiotics.

Therapeutic use of antibiotics to date has been predominantly for the treatment of human patients. However, improved methods of biosynthesis and of processing and correspondingly increased production of penicillin have resulted in such a marked decline in price of this drug that it is now practicable to use it routinely in veterinary medicine. This has opened up a tremendous market and has other economic implications, since it affords a means of protecting the huge investments in the dairy, cattle, poultry, and other live-stock industries, an investment that recently has been estimated at twenty-five billion dollars in the United States alone. Similar developments may be expected for other antibiotics as soon as production increases sufficiently so that the cost to the consumer drops to a level that makes their routine use in veterinary practice economically feasible.

Social Importance of Antibiotics

The savings, in terms of both human values and money, made possible by antibiotic chemotherapy are incalculable. Not only

does proper use of antibiotics sharply curtail periods of hospitalization, thereby reducing the financial burden on community-supported organizations, but often it also returns patients to their normal occupations more rapidly than would be the case with other types of treatment. This is of tremendous psychological and economic benefit to patients and their families, and also has broader economic importance in terms of production of goods. More important than either of these aspects, however, is the rehabilitation of patients who before the advent of antibiotic chemotherapy would have been doomed to prompt death or to lingering, incapacitating illness. Such benefits cannot be evaluated in material terms alone. As more is learned about the antibiotics already available and as more antibiotics are discovered and developed on an industrial scale, the outlook for public health on a world-wide level should become increasingly brighter.

Already plague and typhus, two dreaded and relentless scourges that have always been the aftermath of war and that have frequently decimated populations even in time of peace, have met their nemesis in streptomycin and in chloromycetin, respectively. Tuberculosis can be readily cured in many instances by proper use of streptomycin. Penicillin makes the rapid cure of gonorrhea virtually routine and the effective treatment and rehabilitation of many patients with syphilis and other venereal diseases not only a possibility but a reality.

These facts have important demographic implications for our economy. Development of antibiotics on an industrial scale has made these agents available for general use. This undoubtedly will cause a pronounced change in the distribution of age groups in the population. For a number of years the proportion of elderly people in our population has been steadily increasing, due largely to improved medical and pharmaceutical services. One may now confidently expect a sharp and significant rise in this proportion.

All of these economic and social factors are of the utmost significance for the practicing pharmacist and the health sciences

in general. They pose a challenging problem for those who are entrusted with the grave responsibility of training and educating future pharmacists.

Place of Antibiotics in the College Curriculum

The pharmacist is the logical person for physicians, health officers, and laymen to consult for information concerning all aspects of drugs. Mere familiarity with the official and proprietary forms in which drugs are available will not enable the pharmacist to meet his professional obligations properly and to be of greatest service to the community. He must also possess basic and fundamental knowledge of the principles that underlie production and use of various drugs. He must know what lies behind the label on the package.

Suddenly, and largely without warning, the pharmacist has been confronted, and sometimes confounded, in the last five years by a new class of medicaments, the antibiotics. The pharmacist must understand the principles (and pitfalls) as well as the benefits and limitations of antibiotic chemotherapy. He must be familiar with the numerous factors that can and do modify the therapeutic effectiveness of antibiotics. These factors are by no means limited exclusively to the nature of the infection under treatment and to the condition prevailing in the pharmacy or hospital storage quarters before administration of the drug, or in the ward or doctor's office at the time of administration.

In most schools, some information concerning various aspects of antibiotics is currently given in the regular courses in Pharmacognosy, Bacteriology, Dispensing, etc. But the subject of antibiotics cannot be treated adequately by merely "sandwiching" a few facts into already established courses. Such a procedure is bound to slight some important aspects of the subject and, more important, fails to give the student a comprehensive and integrated view of the subject. "Whatever is worth doing at all, is worth doing well."

The solution to this problem is to establish a separate course (or courses) devoted to the subject of antibiotics. We believe the questions to be answered are not "Shall we offer a course in antibiotics?" or "Should the course be prescribed or elective?" The questions are "When in the curriculum should such a course be prescribed to be of greatest value to the student?", "How much time should be devoted to it?", and "What should its content be?"

Ideally, the student should have some knowledge of bacteriology, organic chemistry, physical chemistry, and pharmacology before embarking on the study of antibiotics and the general phenomenon of Antibiosis. However, to demand all of these subjects as prerequisites would preclude students from taking the course in most schools that are operating on a four-year program.

The course can be given with advantage in any year of the pharmacy curriculum after the student has acquired familiarity with elementary organic chemistry and with a few simple biological principles. Naturally, the value derived by the student from the course will vary directly with his knowledge and understanding of biological and chemical facts and concepts and, therefore, in a four-year program, the course in antibiotics preferably should come in the senior year or, if this is impracticable, in the junior year.

It is difficult for an administrator to decide how much time should be devoted to a new course, especially in an already crowded curriculum in which instructors in already established courses often are clamoring for more time. Some may feel that the course in antibiotics should be reserved for a five or six year program. We do not agree with this view. We believe that the course in antibiotics is so fundamental that *all* future pharmacists should have the benefit of such a course, even if this necessitates reducing slightly the time spent in some other areas of instruction.

In the regular four year program at the University of California College of Pharmacy we offer two one-semester courses devoted to antibiotics. One is a prescribed two-unit lecture course (soon to be expanded by addition of two units of laboratory instruction) in which current factual knowledge is related to the basic principles and theories upon which the whole realm of antibiotics, from production to ultimate application of the drugs in medicine and pharmacy, rests. The other, for which the prescribed course is a prerequisite, is a two-unit elective course in which more advanced problems involved in the industrial, chemical, biological, and clinical aspects of antibiotics are studied and discussed.

An obvious question concerns the course content. What should be included and what should be stressed? Naturally, each instructor will have his own ideas concerning answers to these questions and there will be variations from one course to the next. The following outline is one which we have used successfully for several years in our prescribed course.

I. **The Concept of Antibiosis**

II. **Biological Significance of Fields of Diffusion**
   - A. **Mutual relations among organisms**
   - B. **Discovery of antibiotics from soil organisms**
   - C. **Significance of fields of diffusion**
   - D. **Modification of the sigmoid curve by growth accelerators or inhibitors**
   - E. **The concept of threshold and optimal concentrations**

III. **Industrial Production and Control of Antibiotics**
   - A. **The concept of chemotherapy**
     1. **Requisites for an ideal antibiotic**
   - B. **Industrial production of antibiotics**
   - C. **Government control of antibiotics**

IV. **The Concept of Antibiotic Spectra**

V. **Penicillin, an antibiotic useful principally against Gram-positive pathogens.**

VI. Streptomycin, an antibiotic useful principally against Gram-negative pathogens and the tuberculosis organisms

VII. Chloromycetin and Aureomycin, antibiotics useful against rickettsial and viral infections

VIII. Polymyxin, an antibiotic active specifically against Gram-negative organisms

IX. Tyrothricin, a Surface Active Antibiotic

X. Other Antibiotics

XI. Mechanisms of Antibiotic Action

Discussion of sections I to IV is intended to establish in the student's mind the fundamental concepts and principles involved in man's adaptation of natural antagonisms among micro-organisms to serve his own purposes. In sections V to X specific factual information concerning the different antibiotics is discussed in relation to the principles established earlier in the course. Lack of space prohibits presentation of a detailed outline in this article; but each representative antibiotic listed in the outline is discussed as a microbiological product; as a chemical compound; as a chemotherapeutic agent, including its pharmacology, and factors influencing its usefulness, etc.; and as a pharmaceutical entity. The lectures under section XI are intended to give the student an insight into biochemical means by which different antibiotics interfere with bacterial metabolism while not appreciably modifying cellular activity of the host tissues. The importance of differential cytotoxicity is stressed, especially as it relates to toxic reactions in man that may diminish the usefulness of a given antibiotic.

This program is well beyond the experimental stage in our school, having operated to the extreme satisfaction of students and faculty alike since 1944 under the aegis of the Pharmacognosy division.

The Pharmacy R.O.T.C. at the University of Minnesota

CHARLES H. ROGERS

University of Minnesota

In January of this year, I received an invitation from our secretary-treasurer to present a brief paper on the establishment and operation of the Pharmacy R.O.T.C. unit at the University of Minnesota. I was glad to accept this assignment. I dare say that our experiences, encouraging and discouraging alike, have been similar to those in the other three schools, namely: The Ohio State University, The University of Wisconsin, and The University of California, at which these units have been established.

In the brief time allotted to this paper, I should like to (1) outline briefly the procedure that was followed by the University of Minnesota in obtaining consideration by the Surgeon General's Office for the establishment of a Pharmacy R.O.T.C. unit at our school; (2) relate seriatim the events that preceded the beginning of the Pharmacy R.O.T.C. program; (3) state the objectives of the combined military and professional training; and lastly, (4) give you my personal observations upon student reaction to this offering, the difficulties encountered in putting it into effect and measures that should be taken to overcome the several objections to it on the part of students.

(1) In July, 1943, Congress established a Pharmacy Corps in the Medical Department of the United States Army. This law provided for the establishment of a Pharmacy Officer's Reserve Corps and also Pharmacy R.O.T.C. units. Not before, but immediately after the official announcement, a letter (1944) was addressed to Washington requesting that the University of Minnesota be given consideration if and when, Pharmacy R.O.T.C.

units were established. As you well know, these units were not established during the brief existence of the Pharmacy Corps and therefore, the entire program was inactive. However, when in August, 1947, the 80th Congress abrogated the Pharmacy, Sanitary and Medical Administrative Corps and established the Medical Service Corps, we again reminded the Surgeon General's Office that The University of Minnesota was still interested in having a Pharmacy R.O.T.C. unit established. The setting-up of the new Medical Service Corps did not in any way affect the provisions in the National Defense Act providing for the establishment of a Reserve Officers Corps and Pharmacy R.O.T.C. units. These were the only overtures made for consideration.

On 9 February 1948, my office received a letter from Colonel O. F. Goriup, Chief of the Medical Service Corps, advising us that The Surgeon General had received tentative approval from the Director of Organization and Training, Department of the Army, General Staff, to proceed with plans for establishing four Pharmacy R.O.T.C. units in 1948, contingent only upon Congressional appropriations and that, the University of Minnesota had been selected as having all of the conditions that lent themselves well to the establishment of one of the four proposed units. Preliminary to making application for such unit and official government approval, the matter was presented to the Administrative Committee of the University Senate which unanimously approved making application for such a unit.

By arrangement, Colonel O. F. Goriup, Chief of the Medical Service Corps, visited us on 17 March 1948, at which time a conference was held at which the two Vice-Presidents of the University, the Dean of Admissions and Records, the Controller of the University, the Senior Professor of Military Science and Tactics, the Heads of the three departments in the College of Pharmacy, the Assistant P.M.S.&T. in the Medical R.O.T.C. and the Dean of the College of Pharmacy, were present. Details of the Pharmacy R.O.T.C. were discussed. On 18 March 1948, a formal application for a Pharmacy R.O.T.C. unit was mailed to the Adjutant

General's Office. In General Orders, Number 34, under date of 20 May 1948, the Secretary of the Army established a Pharmacy R.O.T.C. unit at the University of Minnesota, effective 1 July 1948.

During the week of 16 May 1948, Major Leonard B. Zagelow, MSC, who had been tentatively selected for assignment as the Pharmacy Assistant P.M.S.&T. at the University of Minnesota, conferred with us on the details of initiating our unit. We were very happy to approve of his selection for this post of duty and recommended its confirmation. Major Zagelow is a registered pharmacist and a 1937 graduate of the College of Pharmacy at Washington State College. Following his graduation he applied for and received a commission in the Medical Administrative Corps, regular Army of the United States. The Major is a well qualified officer in every respect and his sound pharmaceutical training together with his fine record of military service give him the needed professional and military backgrounds so necessary to the successful discharge of his duties and responsibilities connected with his present assignment. We feel fortunate to have him as our contemporary in this new enterprise.

All new students and also those who were about to enter upon their junior year who came to our office to register on or after 2 August 1948, were interviewed personally by Major Zagelow and were informed about the objectives of the Corps and the requirements for enrollment in the Pharmacy R.O.T.C. unit. Possibly I should mention that the University of Minnesota is following a continuous registration program and because of this procedure, it learned at an earlier date than some of the other schools having Pharmacy R.O.T.C. units, what were the objections on the part of the students to enrolling in this particular R.O.T.C. course. Before commenting upon these, permit me to make a statement covering the objectives of the course of study offered in the Pharmacy R.O.T.C. program.

(3) The purpose of the Pharmacy R.O.T.C. units is to train students enrolled in the aforementioned colleges of pharmacy in

certain military subjects so that when they receive their Bachelor of Science in Pharmacy degree, they will be eligible for appointment as a Second Lieutenant in the Medical Service Corps Reserves, Army of the United States.

The program is designed to supplement the regular pharmacy curriculum so that pharmacy graduates may be better qualified in case of national emergency thus, benefiting their country and themselves. Any male citizen who is regularly enrolled in the College of Pharmacy and who meets the physical and other requirements for an Army Reserve Commission is eligible to engage in the Pharmacy R.O.T.C. training program; however, it is not compulsory that he do so.

It is a progressive program of four years divided into two courses—basic and advanced—with thirty-two hours of instruction annually, arranged as an hour conference or lecture once a week. The students are not required to wear uniforms or attend drill formations. The *basic course* is designed for freshman and sophomore students, and the *advanced course* for juniors and seniors. The basic course is a prerequisite for the advanced course with the exception that former enlisted members of the Army, Navy, Air Force and Coast Guard, with more than six but less than twelve months honorable service are exempted from the first year of the basic course and veterans with more than twelve months service are exempted from the basic course entirely.

The basic course, as the name implies, is basic in character and serves to indoctrinate the student in such subjects as The World Situation, National Defense, and Organization of the Army with particular emphasis on the organization and employment of Medical Department units. Other subjects covered in the basic course are Military Obligations of Citizenship, First Aid, Bandaging and Splinting; Courtesies and Customs of the Service; Military Law, Medical Supply, Introduction to Map Reading and Health and National Security.

Admission to the advanced Pharmaceutical Military Science course is limited to those who have maintained a satisfactory scholastic standing during their freshman and sophomore years in the College of Pharmacy and who have made satisfactory progress in the basic Pharmacy R.O.T.C. courses. The advanced course covers subjects of a more technical nature such as, Military Preventive Medicine, Medical Department Reports and Records, Military Personnel Management, Administration of Military Hospitals, Medical Aspects of Chemical and Atomic Warfare, Pharmaceutical Service in the Army and Mobilization.

Students enrolled in the advanced course are paid a monetary allowance of approximately $27 per month during their two years of advanced instruction. Inasmuch as students in the advanced course receive monthly payments from the Government, they are obligated by written contract to complete the advanced course if started. In addition to the training provided at the University, students must attend a six weeks training camp provided at the Medical Field Service School, Fort Sam Houston, Texas. This encampment is given during the summer between the first and second years of the advanced course or, in exceptional cases, a student may attend the camp after graduation. Transportation to and from the camp is furnished by the Government and individuals receive $75 per month, subsistence and clothing while there. Complete medical attention is also furnished if required.

The selectitve Service Act of 1948, included provisions whereby students in good academic standing engaged in this and other R.O.T.C. programs may be granted a deferment from the draft upon submission of proper application duly approved by Department of M.S.&T. at the University, to their draft boards. This procedure makes it possible for a participant in the Pharmacy R.O.T.C. program to be assured of four years of uninterrupted college study. A student who has successfully completed the Pharmacy R.O.T.C. training and has graduated with the B.S. in Pharmacy is assured of a Second Lieutenant's Commission in the Medical Service Corps Reserves.

At this point it should be mentioned, the Public Law 810, 80th Congress, provides for the retirement of Reserve Officers at the age of 60. In order to qualify for retirement with its benefits, a reservee must have completed 20 years of satisfactory service, both active and inactive service being considered, and shall have met such standards of performance as are established by the various Military Departments.

As stated before, in August of 1947, Congress enacted legislation establishing the Medical Service Corps in the Medical Department of the Army. An identical Corps was created in the Navy at the same time. The Medical Service Corps absorbed the existing Pharmacy, Sanitary and Medical Administration Corps of the Army. The newest Medical Service Corps is divided into four sections: (1) Pharmacy, Supply and Administration Section; (2) Medical Allied Science Section; (3) Sanitary Engineering Section; and (4) Optometry Section.

These sections encompass trained specialists in eighteen fields. The creation of this new Corps enables the Medical Department to provide comprehensive medical care with a minimum of physicians handling administrative problems or doing work which can be handled effectively by these allied scientists. The Chief of the new Corps, Colonel O. F. Goriup, is a pharmacist and holds the rank of Colonel. The authorized strength of the Medical Service Corps, Regular Army, is, as of last May, 1,022 officers. Sixty per cent of the Corps is allocated to the Pharmacy, Supply and Administration Section.

The Pharmacy branch of the Pharmacy, Supply and Administration Section of the Medical Service Corps consists of officers who have graduated from an accredited school of pharmacy which offers an approved four-year course. As of May 1948*, only 75 (12.23%) of that number (613) (60% of 1022) were graduates

*Address by Major General Bliss, "Pharmacy in Peace and War" presented before A.Ph.A. Conference in Washington on 6 May 1948.

of recognized schools of pharmacy and this number constitutes only 7.33 per cent of the total authorized strength of the Medical Service Corps. It is understood that Current Army Regulations provide that whenever available, all pharmacies at Army General and Station Hospitals must operate under the supervision of a commissioned pharmacist who has graduated from an accredited school of pharmacy offering a four-year course. Each General Hospital has a Therapeutic Agents Board composed of two members of the Medical Corps, usually the Chiefs of the Medical and Surgical Services of the hospital, and a Pharmacist from the Medical Service Corps. Every new drug or combination of drugs used or developed at Army Pharmacies are approved by this Board.

(4) Before presenting the fourth part of this paper permit me to say that in my opinion the Surgeon General's Office, having internal authorization, has "leaned over backward" to make the Pharmacy R.O.T.C. program very attractive to entering freshmen and G.I.s alike. The important question is, has the Pharmacy R.O.T.C. program been received enthusiastically by our students who are eligible and, if not, what are the reasons?

First, let us consider our freshman enrollment as of the fall 1948-49. Of the total freshmen enrollment, 56 were G.I.s who had no reason to enroll in the basic course because they had had one or more years in the Service and were waiting until they were juniors to enroll in the advanced R.O.T.C. course. However, there were 80 civilian students in that class of whom 48 (60%) enrolled in the basic R.O.T.C. course. Personally, I am inclined to believe that the majority did so in the hope that their four years of professional training would not be interrupted by draft or national emergency.

Now let us consider the students who were entering upon their junior year at the beginning of the fall quarter in 1948-49. Seventy (70) G.I. students were eligible to the advanced course of the Pharmacy R.O.T.C. by virtue of their having had 12 or more

months of service. Of this number only 20 (28.57%) enrolled in the advanced course. Why this lack of interest? First, possibly because they were exempt from the draft because of marital status or years of service, Second, because some of them had their "visceras" full of army life (to me a surprisingly few), Third, because the six or seven weeks of training in camp interferred with/or interrupted their acquisition of the one year of practical experience required by law for eligibility for licensure examination, and Fourth, if, after receiving their Second Lieutenant's Commission in the Medical Service Corps Reserves, they wanted to qualify for commissions in the Medical Service Corps of the Regular Army of the United States it would entail one year "competitive tour". Colonel Goriup advises me that this so-called "competitive tour" does not necessarily mean that those Reserve Officers permitted to enter such tour are in competition with other former R.O.T.C. students having their Second Lieutenant's Commission in the Reserve and also with those civilian pharmacists who had received Reserve Commissions in the M.S.C. and are applying for commissions in the Regular Army. Actually, it means that these Reserve Officers on tour are competing with a standard and, because of the careful screening and selection exercised, permission to enter on tour is tantamount to appointment to the Regular Army at the end of the tour.

Of the four previously stated causes for lack of interest in enrolling in the Pharmacy R.O.T.C., I definitely would place the interruption of practical experience training in the number one position. In any number of cases that I personally reviewed, this interruption of apprenticeship training precluded the graduate from taking the licensure examination either at the July or the January State Board of Pharmacy Examinations, following graduation on the preceding June. These G.I.s who by virtue of previous military experience had an unusual background for making above-average commissioned officers in the Medical Corps Reserves were determined to get their licenses to practice Pharmacy just as soon as possible after graduation and were not disposed to have the R.O.T.C. camp interfere. This, of course, precluded training them for strong officers for the Medical Service Corps Reserves.

It is my opinion that if the National Association of Boards of Pharmacy would accept for reciprocal registration not more than two months training in camp as applicable toward the one or more years of practical experience only for those students in the advanced course in the Pharmacy Reserve Officers Training Corps, a large part of the presently observed antipathy on the part of all pharmacy students to enroll in the Pharmacy R.O.T.C. would be removed. This matter is now before the National Association of Board of Pharmacy for consideration and, if approved, I believe that it will remove what we have sometimes considered an almost impossible barrier to the success of these Pharmacy R.O.T.C. units.

The Second most important objection to the R.O.T.C. program on the part of students is that after they receive their Second Lieutenant's Commission in the Medical Service Corps Reserve they must compete for one year on a tour of duty for a commission in the Regular Army. With prevailing salaries for registered pharmacists what they are, how many of our Pharmacy R.O.T.C. graduates will apply for commissions in the Regular Army? My guess is very few and as a result it might be necessary for The Surgeon General to commission hospital administrators, supply specialists, accountants, and even businessmen in the Pharmacy, Supply and Administration Section of the Medical Service Corps, because of a lack of applications from those who are graduate pharmacists. We, of course, would not like to see this happen, but to preclude its taking place, it will be necessary for us to do our part and make a strong trained personnel available to The Surgeon General.

Based upon student-interest in the suggestion that when they graduate and have their Second Lieutenant Commission in the M.S.C. Reserves, they might want to consider the Army as a career, I am inclined to believe that some of them would make application for a commission in the Regular Army of the United States if they had any assurance whatsoever that their Pharmacy R.O.T.C. and professional scholastic records would be the bases or even the principle factors in determining their fitness for such

a commission. Under *those* conditions, I think they would apply regardless of the fact that the compensation of a Second Lieutenant, Regular Army, is far less than that which they could receive in civilian practice. What I am trying to say is that, in my opinion, only a very few of our young, physically fit R.O.T.C. and B.S. in Pharmacy graduates will be interested in taking a year off from a $5000 or better job in order to engage in competition, even against a standard.

It is not within the scope of this paper and it would be presumptuous indeed for a layman to discuss the merits of an administrative decision of the Army relative to "competitive tours" or any other military matter. It is intended to report from the front line what we know to be the reactions of students to them. Our faculties and Assistant P.M.S.&T.s have a selling job to do and it will be a very difficult one unless the uncertainties are minimized or entirely removed.

It has been with considerable amount of effort that I have restrained myself to the topic at hand and not launched forth in a discussion on the part the graduates of our college of pharmacy have been accorded in the overall functioning of the Medical Service Corps both before and after the so-called "integration" period. However, this is not the time nor the place for such considerations although it may be said that we believe your representatives on the Committee on Status of Pharmacists in the Government Service are working hand in hand with Army, Navy and other Government authorities and are abreast of official thinking. Now that the Pharmacy R.O.T.C.s have been initiated and actually functioning, we believe it is well worth while giving them the wholehearted support of our educational society and our licensing boards in order that they be given a chance to achieve those objectives for which they were organized.

MARRIAGES

Dean Charles H. Stocking, University of Michigan, and Mrs. Ethel B. Gregg of Ann Arbor and Britton, on December 26, 1949, at Ann Arbor.

The Pharmacogenetic Influence of Natural Substances and Their Consideration in the Pharmaceutical Curriculum

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Among the difficult tasks confronting those currently engaged in pharmaceutical education is the problem of correctly defining the scope of individual courses which make up the complex aggregate of the curriculum. Academic training in pharmacy is complicated by the diverse origin of drug and related agents as well as by the unceasing accrual of new agents for consideration along with those of long standing acceptance. As a consequence the number and variety of drugs to be reckoned with has become considerable. Because of the continued current rapid pace of drug development and the future acceleration of this pace, it is of utmost importance that all courses be kept functionally flexible to meet the ever changing and progressive advancement of our drug knowledge, *without losing sight of the factors that have contributed to this advance.*

One of the aspects of the present Pharmaceutical Survey is the study of the existing academic program to formulate definite recommendations for its improvement. With the assistance of a consultative committee The Survey has promulgated a report on pharmacognosy designed to define the exact position this area is to occupy in the undergraduate curriculum and to make recommendations as to scope and organization of subject matter.[1] An examination of the various opinions expressed in regard to the preliminary draft reveals general agreement with the purpose of the report but an apparent lack of understanding as to the advantages to be gained from reorganizing the subject matter to more effectively implement the proposed revitalization of this area of pharmaceutical training.[2]

[1] Pharmacognosy in the Pharmaceutical Curriculum, The Pharm. Survey, Jan 29, (in press)

[2] Communications in response to the preliminary draft of a Report of Pharmacognosy in the Pharmaceutical Curriculum.

Pharmacognosy at present is an ill-defined concept of our present curriculum simply because drug knowledge, and quite naturally drug emphasis, has outgrown the original intent of this particular discipline. The fundamental considerations which have evolved as a result of this change of emphasis are:

a. **Since our present and future regard of pharmaceutically important substances of natural origin are the chemical constitutents, is it possible for pharmacognosy to adopt a functional point of view to extend its present descriptive role; and**

b. **If the adoption of a more functional aspect in this area is conceivable, how should this extension of the crude drug consideration manifest itself with respect to related areas?**

The historical development of our present limited discipline of pharmacognosy is familiar to all. During the period of development of our knowledge of drugs which extended over a period of several thousand years, crude drugs were gradually accepted as useful by the simple process of trial and error. The knowledge gained from this process was known by the name of "materia medica". It is readily understandable that because of the slow pace of development of this body of knowledge and the lack of information of the inherent active constituents, principal emphasis was placed on crude drug description. This emphasis has persisted in spite of the fact that with the passage of time crude drugs have become merely sources of supply for the pharmaceutically employed products or constituents.

No extensive analysis of the situation is necessary to indicate that crude extraction mixtures from natural origin are rapidly disappearing as an accepted mode of drug administration. The important aspect of this area of pharmacy, however, is that in many instances as a crude drug is deleted from official recognition, a purified chemical principle from this same drug or another entity from a natural source never granted official recognition is admitted for inclusion. If it is conceded that official recognition indicates therapeutic or pharmaceutical usefulness of newly admitted agents, an examination of U.S.P. and N.F. substances of plant origin, for example, shows no appreciable change in the

total number recognized during the past fifty year period.[3] How is this possible in view of the fact that every revision of these official compendia is characterized by the deletion of significant numbers of crude drugs? Commensurate with crude drug deletion there has been a progressive increase in the recognition of plant products in the form of purified or modified substances. In the case of animal products the trend is even more pronounced in that the currently recognized products of animal origin are approximately twice the number given official standing some fifty years ago. In view of this present and most probable future trend of drug consideration, is the current presentation of natural products on the basis of taxanomic groupings of their crude sources the most advantageous? Do present trends in the types of drugs being recognized justify the minimization of drug plants and plant and animal drug products with which pharmacognosy is concerned?

Research in the development of new therapeutic agents is noticeably being directed along the lines of chemical homologs. Arnold Welch in a recent review of research progress in pharmacology states that the modern science has to a considerable extent evolved from two events which took place within the last two decades.[4] The first of these, in 1907, occurred when Paul Ehrlich first developed organic arsenicals capable of killing pathogenic parasites and introduced to a large extent the field of synthetic organic compounds. The second event, destined to influence our present concept of chemotherapy to an even greater degree, occurred in 1940 when Woods and Fildes showed the antagonism between p-amino benzoic acid and sulfanilamide.

Prior to these two events, the synthesis of therapeutic agents was based largely on the empirical approach of ostensibly relating chemical constitution to biological action. In the future, according to Welch, we shall witness the extension of the general concept of inhibitions in chemical systems. Future research in pharmacology will be based on the study of structural analogs of chemical sub-

[3]Gathercoal and Wirth, Pharmacognosy, Second Edition 1947, p. 28.

[4]Welch, A. D., Progress of Research in Pharmacology, American Professional Pharmacist, February 1947, p. 151.

stances vital to bodily functions or vital to parasitic organisms unfavorably affecting normal bodily functions. Radio-active trace factors and structural analogs of chemical substances devised from trace factor studies will be employed in research. Information revealed from the study of biological interference of antibiotics and other fields and the function of antagonistic normal biological systems will be employed in the development of new therapeutic agents. Similarly, analogs of existing drugs are, and will continue to be prepared which result in a slightly different mode of action, or as has been found in many cases, an entirely different mode of action from the parent compound. Ultimately, the fundamental chemical reactions taking place within each cell itself will be determined and each bit of knowledge will offer unlimited possibilities in the development of more potent and useful therapeutic agents. From numerous indications it seems that as more critical investigations are undertaken in regard to either pharmacodynamic or normal biological activity, many if not all biological systems possess or develop antagonistic counterparts.

How does the present descriptive discipline of pharmacognosy fit into the whole picture of future research and utilization of therapeutic agents? In truth, it must be admitted that the present restricted concept does not.

In view of this present academic limitation of the field, has there ever been an effort to define the area of pharmacognosy with respect to the changing emphasis in drug consideration? An answer to this question might be forthcoming if we review some of the earlier concepts of what position this area was intended to occupy in the whole complex field of drug consideration. In a recent comment of the derivation of concepts within the field of drug science it has been pointed out that by initial connotation, pharmacognosy was not designed to restrict its consideration to the purely descriptive aspect of drug knowledge.[5] Richard Wasicky, the Viennese pharmacist-physician, in his classifications of the various areas of drug consideration employed the term pharmacology to mean the science of drugs. He further divided

[5]Urdang, G., The Scientific Monthly. February 1945, p. 161.

this broad field into pharmaco-dynamics, meaning the science of the effect of drugs, and pharmacognosy, as the science which treats of the chemical and physical qualities of drugs. Pharmacognosy in turn was again sub-divided into physio-pharmacognosy, the science which treats with the description of drugs of vegetable and animal origin and pharmaceutical chemistry, the science which treats with the chemistry of drugs. If we take cognizance of Wasicky's classification of the various areas of drug sciences, pharmacognosy then has actually never asserted itself as an effective functional discipline because of its present recognition solely as physiopharmacognosy. Thus it has been implied even in the past that a functional type of pharmacognosy can only result from the combination of drug chemistry with that of drug description.

A further elaboration of this same concept of pharmacognosy was recognized by Alexander Tschirch who described this area of pharmacy as the science whose task it is to scientifically investigate, correctly to describe, and to systematize according to general points of view drugs of vegetable and animal origin.[6] The final task of pharmacognosy, as viewed by Tschirch, was to be a grouping of the drugs according to their contents and to come gradually to a pharmaco-chemical system of classification that would serve as a lead to pharmacology.

These two formerly expressed concepts deviated very little if any in recognizing the position of pharmacognosy in the drug sciences as a subsidiary field of pharmacology dealing not only with the description, but also the chemical composition of natural substances.

The desirability of promoting the more functional association of chemistry to the present area of pharmacognosy becomes more apparent when the future trends in pharmacological research are considered. Moreover, pharmacology itself is admittedly in need of a reorientation, and a change of emphasis has recently been suggested in this parent field of drug science to also more fully

[6]Tschirch, A., Handbuch der Pharmakognosie, Second Edition, 1930.

cope with the progressive pattern of drug evolution. Paul Lamson, a pharmacologist, has expressed the opinion that even pharmacology itself is not a well established medical discipline and that it should be replaced with a new point of view.[7] It is the contention of Lamson that pharmacology should be taught from the point of view of the human organism instead of the drug administered. To clarify this he goes on to state that when we speak of the *action* of a drug upon the human body, the observed result is not the action of the drug, but the *reaction* of the body toward the drug introduced. At present, the attention of the medical scientist has been concerned with studying the reactions of the human organism to stimuli of different sorts, notably disease and chemical substances, in an effort not only to learn more about the functions of the body, but also to obtain the means of bringing about desired reactions in disease.

At the present time, however, according to Lamson, we are confronted by the problem that there is occurring an ever widening gap between the biological and non-biological (in this case the chemical) sciences involved in medicine. Delegation of responsibility is needed to bring these two sciences ever closer together into a complementary working scheme. The chemist already has a multitude of potential drugs synthesized in his laboratory or the means of synthesizing them and an unlimited number still to be elucidated from natural sources; but they will remain undiscovered until he is aided in making a decision on what types of substances are needed for the cure of disease or for the influencing of physiological or pathological functions by someone trained in explaining the biological needs in chemical terms. If this is a need of reorientation in pharmacology, what then remains to be desired in pharmacognosy as a subsidiary field among the drug sciences? The desired approach would be an explanation of drug evolution from the biological point of view for chemical interpretation, according to Tschirch's recognized objective of this field, to come gradually to a pharmaco-chemical system of drugs from natural origin that serves as a lead to pharmacology. In other words, would it not be more advantageous to emphasize the generation

[7] Lamson, P., Biotrepy. The Scientific Monthly, September 1944, p. 215-220.

or evolution of the drugs in current use from the natural source and consider the crude source itself only in those cases where it contributes to the ultimate useful biological application of the constituent?

In both the past development of many currently used therapeutic agents as well as in the future evolution of similar substances one concept remains tantamount—the generation of chemical analogs based on chemical structure. Natural substances exert an important influence in *pharmacogenesis* (pharmaco, a drug and genesis, the evolution or generation). The pharmacognetic consideration is in reality the basic factor which differentiates the emphasis of pharmacognosy from that of pharmacology, and unequivocally establishes the former area as one of the important sub-divisions of the parent science of drug knowledge. As implied by Goodman and Gilman, pharmacology deals with the most frequently employed therapeutic agents and then only with their usage; As has been pointed out elsewhere, the pharmacologist's attention is directed toward channels different from those of one concerned with drug pharmacogenesis.[9]

Actually, the desirability of reorienting the present area of pharmacognosy with respect to greater emphasis on the pharmacogenetic influence of natural substances implies no radical departure from the normal consideration of subject matter in the pharmaceutical program. We in pharmacy are, and shall continue to be, primarily interested in the point of view of pharmacogenesis—the generation of new drugs conceived by the study of the evolution of drugs in current use. The current synthetic agents derived from a study of the functional chemical groupings which gave therapeutic qualities to an initially employed natural constituent of plant or animal origin represents an explicit example of drug evolution. This same pattern of drug development is evident in the purely synthetic phases of drug chemistry and can be described in many cases as a continuation of pharmacogenesis into the area

[8]Goodman and Gilman, The Pharmacological Basis of Therapeutics, 1941, p. 3.

[9]Youngken and Neva, Teaching the General Course in Pharmacognosy According to Physiological Pattern, Amer. Jour. of Pharm. Ed., Oct. 1949.

of synthetic pharmaceutical organic chemistry. Thus, the evolution of current drugs can then obviously originate with a natural substance and be a continuation of that process or can originate quite apart from any previous study of natural entities at which time the deliniation between the two phases is indistinguishable.

Yet to be more successful in the over-all picture of generation of these new drugs we must first bridge the gap between the biological and non-biological sciences; and the only positive way in which to accomplish this for the benefit of the entire concept is to extend our point of view in such a way so as to contribute more effectively in knowledge to pharmacognosy, our science of the physical and chemical qualities of vegetable and animal drugs. Instead of tolerating the misconception that the current physiopharmacognosy is pharmacognosy, those interested in the betterment of pharmaceutical education must subscribe to the fact that pharmacognosy's responsibilities enlarge progressively as we discontinue the use of crude drugs as such and begin to use the purified or modified chemical constituents from vegetable and animal origin as the active therapeutic substances. Only with the full realization that all areas of pharmaceutical instruction have progressed to a point where we explain not only drug action but drug description as well in terms of applied chemistry, will it be possible to implement a tenable status in the curriculum for a reorientated pharmacognosy. The greater application of chemistry to pharmacognostical investigation and instruction is not only desirable but fundamental for its scientific continuance. The proper limits of this application shall be governed by the degree of pharmacogenetic influence a particular natural entity has exhibited in the systematic grouping of the integral aspects of this over-all influence of natural products on present day pharmaceutical agents. The manner in which this systematic grouping manifests itself should not be rigidly expressed; but obviously, if the point of emphasis in a functional type of pharmacognosy is the chemical entity, then the basis of grouping must take into cognizance the implicit pharmacogenetic chemical relationships. Pharmacogenesis within the area of pharmacognosy would not necessitate the immediate abolition of physiopharmacognosy as so

many short-sightedly advocate but would enable the normal deletion of this phase of presentation in line with the change of emphasis.

Summarization of Discussion

The need for drastic revision of subject matter in pharmacognosy has been recognized and advocated by interested members in this area of pharmaceutical training. The recommendation for greater emphasis on chemical composition and therapeutic action of natural products with which this area deals has not met general acceptance because of the unclear delineation of exactly how this greater emphasis will constitute a separate descipline within the whole area of drug science. An examination of the future pattern of drug research and a realization of the inadequacy of our present concept of this field to effectively contribute to this trend indicates that pharmacognosy, in order to remain functional with the change of emphasis, must adopt a discipline in keeping with this change. A reiteration of previously expressed concepts of the position of pharmacognosy implies that this area must systematize its subject matter on the basis of chemical constituents so as to pointedly correlate the products and constituents of natural origin with respect to therapeutic or pharmaceutical usefulness. A correlation of chemical composition of constituents to biological application in this case bears a direct relationship to the influence of natural substances on drug development or pharmacogenesis and delineates the extent of chemical application in this area of training. The confinement of this discipline to the pharmacogenetic influence of natural products distinguishes this area from pharmacology which serves as the over-all parent drug science. Finally, the implementing of this specific discipline within pharmacognosy requires the presentation of subject matter along lines other than the currently employed taxonomic grouping of plants and animals to enable the correlation of the chemical constituents with biological usefulness.

Industrial Literature in Visual Instruction*

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In many instances the printed material distributed by the pharmaceutical industry is well worth the teacher's attention both for the information contained and the excellent illustrative features supplementing the text. Frequently the illustrations are the work of specialists in the field and they are usually far superior to those appearing in textbooks or other sources. The diagrams or chematic drawings are especially useful in clearly showing a sequence of events as heart activities in connection with electrocardiograms, steps in blood coagulation, fluid balance in capillaries under normal conditions and in edema. We may speak of atonic and spastic constipation in connection with cathartic drugs but these terms have more meaning if the student sees a pictorial representation of these conditions. Xerophthalmia, cheilosis, scurvy and rachitis in vitamin deficiencies as well as the hormonal influences in reproduction can be more readily appreciated when the reading assignment is supplemented by pictures. The pharmacist, as an auxiliary agent in venereal disease eradication, should know the ultimate effects or syphilis and these can be most forcefully shown by pictures.

A collection of illustrative materials from industrial sources has been accumulated for use in pharmacological teaching at Columbia, either by projection or by display of the original illustrations mounted on heavy paper. With small classes and scarcity of film during wartime, the latter method was practicable and probably preferable for determining class response before going further. With a favorable class response and the impracticability of distributing the material in large postwar classes, opaque projection was tried. Although a large Balopticon with high illumination intensity and a six inch projection lens was available, the results were not entirely satisfactory. The intense heat and lack of clarity beyond twenty foot projection distance were the chief

*Read before the Conference of Teachers of the Biological Sciences at the 1949 meeting at Jacksonville.

objections. Mr. Fred Baden, graduate student, suggested filmslide reproductions and undertook the work.

The photographic equipment used included a Leica camera with f2 lens, sliding ground glass focusing attachment, sliding arm, copying stand extension tubes 15mm to 75mm length and No. 2 photoflood lamps in aluminum reflectors. The effective working distance varied from six inches to about two feet. Exposure data was obtained by using an exposure meter and calculating the corrected exposure by directly reading the reduction on the calibrated ground glass, then referring to a table of equivalent exposures. The combination of shutter speed and large aperature was used to give maximum sharpness of detail and allow for possibilities of slight loss in critical focus.

In selecting illustrations for reproduction it is well to have regard for good contrast between portions of the illustration, fineness of screen in photoengravings and crowding through the inclusion of excessive detail or numerous captions in small print. In dealing with colored illustrations the colors should be pronounced and of good contrast. The pastel colors occasionally used with good effect in printing may be disappointing in the photographic reproduction.

While the bulk of our illustrative material has been drawn from the publications distributed to physicians, occasionally a pamphlet or advertisement has included tabulations or pictures suitable for our purpose. The several pharmaceutical firms have been cooperative regarding reproduction of their printed material, merely requesting that suitable acknowledgment of source be made and that it not be reproduced for sale. The journals represented in our slide collection include: *"Physicians Bulletin"*, Eli Lilly Co.; *"Therapeutic Notes"* and *"Modern Pharmacy"*, Parke Davis Co.; *"Seminar"*, Sharp & Dohme; *"Scope"*, Upjohn Co.; *"Merck's Report"*, Merck & Co. and *"Roche Review"*, Hoffman La Roche. Illustrations and tabulations have also been reproduced from separate pieces of literature distributed by these firms and by the Winthrop Company.

Although our immediate concern is with material which may be of use in our pharmacological teaching, this industrial literature frequently contains illustrative materials of equal value in other teaching fields. We are filing such material with an idea of eventual filmslide reproduction under the following designations: anatomy, histology, physiology, bacteriology, parasitology and chemistry of medicinal products.

Many industrial firms are willing to furnish motion picture films for showing in pharmacy schools, but these films frequently deal with surgical procedures and with the merchandising of drug products. It is probable that those showing the intricate details of surgical operations are of little value in pharmacy instruction. On the other hand those in field of merchandising are frequently of direct value in connection with teaching dealing with the business aspects of the store.

In our use of filmslides in class work we usually arrange a showing at the conclusion of a particular lecture topic or a series of lectures on a group of medications. The instructor gives appropriate explanations and emphasizes details appearing in the projection and frequently answers questions put by students. The original illustrations are displayed on the lecture table so that students may have opportunity for a second look at any of particular interest or about which further explanation is desired.

Although filmslides suitable for pharmacological teaching cannot be had from the supply houses, there should be little difficulty in building up a set. Many teachers are experienced in photography and almost every student body includes camera enthusiasts who are usually very willing to participate. The pharmaceutical industry has furnished a wealth of material for the purpose and apparently has no objection to its use for teaching purposes. Under these conditions any school can have visual instruction in pharmacology and allied fields with increased effectiveness of teaching.

The Effect of the Increased Prescribing of Proprietaries on the Teaching of Pharmacy Courses*

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One of the most consistent criticisms which this writer has heard of the school of pharmacy curriculum by practicing pharmacists is the statement that it is not kept "up to date". Such criticisms are apparently aimed at our failure to include in the course-content discussions of many of the substances which are widely used in prescription practice. Pharmacists have been heard to say that schools of pharmacy should substitute the catalogues of some of our large drug manufacturing companies for the United States Pharmacopoeia and the National Formulary as sources of course material. While the author does not subscribe to this opinion, he must admit that there probably are deficiencies in the syllabus of pharmacy courses as now constituted in some departments of pharmacy. One of our shortcomings may be the failure to present essential material concerning proprietary** medicines.

Members of this conference are well aware of the change which has taken place in recent years with regard to the use of patented and of proprietary substances in prescriptions. I say that members of *this* group are aware, because several of our distinguished colleagues have rendered valuable assistance by conducting prescription surveys which have analyzed the direction of prescribing tendencies.[1, 2, 3, 4]

Time was when a noted professor of pharmacy at one of our well-known schools of pharmacy could smugly say, "if a man desires to call himself a pharmacist, he must, of necessity and

*Read before the Conference of Teachers of Pharmacy at the 1949 meeting at Jacksonville.

**Since the term "proprietary" as it refers to drugs and medicines usually connotes a secret formula, we shall use the more recent term "prescription specialty" through most of this report. We believe that the subject in which we are interested is the increased prescribing of manufactured items whether specialty or proprietary.

desire, make all of the preparations named (official liquors, elixirs, etc.) to be worthy of that name".[5] But time alters all things, and certainly the statistics gathered by various surveys indicate that this attitude can hardly be valid today—else we have a majority of pharmacists who are not now worthy of the name.

The Charter's Survey (The Commonwealth Study), with which we are all familiar, reported in 1927[6] the following information which is pertinent to our discussions: "Of the total number of preparations prescribed (40,610), 30,168 or 74.29 per cent were U.S.P., 2,919 or 7.19 per cent were N.F., 4,180 or 10.29 per cent were proprietary. The balance, 3,343, or 8.23 per cent, were non-official." The significant fact to be noted is the low incidence of proprietary and non-official items, a total of 18.52 per cent in all.

The Charter's Survey, which rightfully influenced the construction of the Pharmaceutical Syllabus for many years, gave little heed to the class of preparations called proprietaries, for their usage was slight as compared with the usage of official drugs and preparations. The source of drugs and preparations to be included for discussion in the pharmacy curriculum in 1927 could rightfully be said to be almost exclusively the United States Pharmacopoeia and the National Formulary.

The Pharmaceutical Survey has served its purpose well in pointing out changes which have taken place in pharmaceutical practice since the time of the Charter's Survey and in focusing attention upon alleged shortcomings in the pharmaceutical curriculum. One of the findings which has caused much comment is the disclosure that a large proportion of present-day prescriptions call for the inclusion of ingredients belonging to that group of agents which are called by The Survey Committee "prescription specialties". Of 12,668 prescriptions, the data on which were sufficient to permit classification, 60.8 per cent called for at least one prescription specialty, 33.6 per cent called for at least one U.S.P. item (plus 3.2 per cent which called for U.S.P. items

with brand specified), and 7.4 per cent called for at least one N.F. item (plus 0.3 per cent which called for N.F. items with brand specified).

The terms "prescription specialty" as used by The Pharmaceutical Survey and "proprietary" as used by the Charter's Survey are not identical in meaning. The method of recording statistics on prescription ingredients was also different in the two surveys. It is, therefore, impossible to make an exact comparison of the results obtained by the two, but there is sufficient similarity that broad conclusions can be drawn. For example, it is apparent that in the years 1924-1926 (the period covered by the Charter's Survey) the majority of prescription ingredients were recognized by the United States Pharmacopoeia and the National Formulary. During the period of The Pharmaceutical Survey the incidence of official items is second to the prescription specialties in number of occurrences. Official items were prescribed in a total of 44.5 per cent of prescriptions, while prescription specialties were used in 60.8 per cent of instances.

The ten most frequently occurring drugs inclusive of prescribed and unprescribed occurrences and exclusive of alcohol and water as revealed by The Pharmaceutical Survey are: thiamine hydrochloride, riboflavin, phenobarbital, glycerin, sucrose, nicotinamide, Vitamin D, ascorbic acid, codeine sulfate, and Vitamin A. All of these drugs are recognized by the United States Pharmacopoeia. However, this fact alone cannot serve as the whole basis of our thought, for six of these ten basic drugs are vitamins, and all who are aware of current practice will realize that the largest use of vitamins is in the form of specialty formulas. This fact will be revealed by a close scrutiny of the information contained in the Prescription Study. For example, thiamine hydrochloride was prescribed as such 153 times, but not prescribed as such 1,195 times. The official tablets were prescribed with no brand specified 60 times. All other occurrences were for thiamine hydrochloride in proprietary or non-official forms.

The evidence as presented by The Prescription Survey seems to clearly indicate that the intelligent compounding of today's pre-

scriptions requires some knowledge on the part of the pharmacist of the class of preparations referred to as prescription specialties. If incidence of occurrence were our only index of importance, we might say that a knowledge of such substances is more significant than is a knowledge of "official" items.

The question which now presents itself is whether we, as teachers of pharmacy, should alter our curriculum in such a way as to recognize the increasing emphasis upon prescription specialties which has been so well demonstrated. In accordance with the topic as assigned, we shall concern ourselves only with the curriculum of the pharmacy department.

Before answering the question, we must give consideration to the objectives which we hope to attain through the teaching of our pharmaceutical subjects. In this connection I shall cite the third of five objectives of a professional educational program as enumerated by James E. Cutler of Western Reserve University in his article "Professional Education":[7] "Skill in the practice of an art based upon the professional knowledge and its application. For the professional student there are required to achieve this objective special facilities, related as closely as possible to local current practice . . ."

As it relates to the familiarity of the student with prescription ingredients, we interpret this statement to mean that the student of pharmacy should gain a familiarity particularly with those procedures and substances which are commonly used in local current practice. In the light of the survey results just cited, this would require the inclusion of some instruction in prescription specialties in any curriculum to be adopted now or in the future. The evidence seems all too clear that the U.S.P. and N.F. can no longer serve as the entire source of material for a pharmacy syllabus. We do not wish to imply that these books have served as the only source of such material in the past, but we are aware that they have overshadowed the thinking of pharmacy teachers and of state board examiners in some instances to the point of virtual monopoly.

If we are now agreed that instruction in prescription specialties should be given a place in our curriculum, several questions immediately present themselves and these will be recorded and answered in turn.

Should the responsibility for this instruction be placed in the department of pharmacy?

We believe that this question can be answered affirmatively. While it is true that many facets of information concerning the specialties might be touched upon in courses such as organic chemistry or pharmacology, it is in the courses of the pharmacy department that we are best able to correlate all of the information which is most essential to their intelligent usage. It is the pharmacy department which is accustomed to the correlation of physi- the correlation of all of these with the proper method of prepar- cal and chemical properties with pharmacological action and with ing dosage forms, including the avoidance of incompatibilities, proper choice of compounding techniques, and all other information of a general nature. Furthermore, it is possible (through use of a plan which will soon be outlined) to include this material in courses which are now in the pharmacy portion of the curriculum. Finally, it is usually the personnel of the pharmacy department who are most closely allied with the actual practice and are, therefore, most likely to be interested in keeping abreast of the ever-changing tide of manufactured items. This is not said in criticism of the personnel of other departments in the school of pharmacy, but in recognition of the fact that the bonds between the corner drug store and the department of pharmacy are and should be stronger than those existant with most other departments in the school of pharmacy.

When should the information concerning specialties be presented?

While this cannot be answered entirely independently of the next question to be asked, we will say that it should be taught late in the course—during the junior or senior years, or both. Before attempting to understand specialty formulas, the student

should preferably have a knowledge of inorganic and organic chemistry, pharmacognosy, pharmacology, general pharmacy, and pharmaceutical jurisprudence. Consider, for example, the newer specialties containing procaine penicillin G and crystalline sodium penicillin G in an oily suspension containing aluminum monostearate. In order for the student to properly understand these preparations, it is desirable that he should know something of the pharmacology of penicillin, enough organic chemistry to understand the chemistry of procaine and of penicillin, something of colloidal chemistry and emulsifiers, and the generalities concerning parenteral medications. It is only in the more advanced years, such as the senior year, that the student's background will have included all of the necessary courses.

How can the material be presented?

This is the most difficult question of all to answer, for the curricula in different schools of pharmacy are quite divergent. In some schools of pharmacy, for example, the problem has already been recognized and courses have been included in the schedule which deal in part, at least, with prescription specialties. These courses are called by such names as New and Non-Official Remedies, The Pharmacy of Synthetic Drugs, etc. In other schools the material is included in the customary courses of the pharmacy department.

We do not believe that it is necessary to add special courses to the pharmacy curriculum in order to impart the essential information. We believe that it can be presented in courses which are already in existence, such as the Pharmacy of Organic Medicinal Products.

We suggest a method that is used in several schools of pharmacy, including the school with which this writer is associated, and which is similar to that described by Griffith and Tice[8] in an *American Druggist* article entitled "Teaching Pharmacy Realistically". In the course in "Senior Pharmacy" all official organic drugs are studied in relation to their chemical structure. That is,

the alcohols are studied as a group, the ethers are considered in a common study, and all other compounds are organized into a logical progressive chemical classification. As the official drugs are presented, related specialties or proprietaries are also demonstrated and discussed. For example, the discussion of barbiturates is not limited to the official examples, but it includes also such unofficial compounds as Butisol Sodium, Sodium Seconal, and many others. Not only are unofficial barbiturates discussed, but also the chemical identity between Nembutal and Pentobarbital and Luminal and Phenobarbital are mentioned. (The students have been given adequate instruction concerning the necessity for respecting trade-mark limitations).

Special preparations containing non-official drugs are discussed whenever time permits or whenever there is something significant in their usage, incompatibilities, or pharmaceutical nature. For example, the preparation "Par-Pen" is given special mention because its compounding requires a special technic which is unique with this particular preparation.

We believe that information concerning the proprietaries can best be correlated through association with the official analogues. For example, when the student first encounters such a proprietary name as Cortate, it probably is meaningless to him. But if he is told (or if he reads on the label) that it is desoxycorticosterone acetate, he will presumably associate it with the official monograph for this drug. Through a common association he can now recognize the identity between this drug and another specialty called DOCA. The relationship to Cortate and other extracts of the adrenal cortex should also be obvious. A similar procedure is used in presenting the inorganic drugs and related specialties, but there is far less activity in this field at the present time than in the field of organic medications. In fact, we can find in the U.S.P. and N.F. official correlaries for useful drugs and preparations of almost any nature.

Information concerning the incompatibilities of the specialties and any unusual compounding problems can well be covered in

dispensing pharmacy, and we would suggest that more of this be done than is current practice. However, it is doubtful that laboratory exercises involving the specialties are of first importance since an elixir is an elixir and a syrup is a syrup regardless of its drug content. Recognition of the chemical nature of the active constituent is, in our opinion, the most important consideration. It may be desirable to devote more than one academic year to this subject. At Temple University the organic portion begins with the second semester of the junior year.

What prescription specialties shall we discuss?

It was difficult to frame a satisfactory answer to the preceding question; it will be impossible to make an answer that will meet with general agreement, for this is the point at which the best judgment of the individual teacher must be brought into play. However, a few general suggestions will be made.

First of all, we do not believe it is feasible or essential that all specialties be discussed or even mentioned. The rote memorization of a series of trade names and manufacturer's descriptions is indefensible in the light of modern educational practices, and time would allow of little else if all are to be included. Furthermore, a large percentage of proprietary items which are popular today will soon be forgotten and newer or more improve preparations will have taken their place. It is difficult to justify the diversion of a large portion of the instructional time to a discussion of items which are to have a very limited period of usefulness. On the other hand, some of the instructional time is sure to be wasted, because inevitably some of the preparations chosen for discussion (whether offical or proprietary) will lose their popularity or usefulness before the student has had an opportunity to exercise his knowledge. This situation is not new in pharmaceutical education. The number of items which any one of us studied in school and have not since encountered in professional practice prescription ingredients or which show promise of becoming useful items.

One of the best guides to non-official preparations which have would be quite extensive. What we must attempt to do is to select those proprietaries which have already become well-established as become well established is the book *New and Non-Official Remedies*. The author would strongly urge a more extensive use of this book in schools of pharmacy than has been common in the past. The various prescription surveys are also most helpful in revealing the names of preparations which are widely used. These will be common knowledge to all who maintain a close connection with retail dispensing practice. In many instances preperations have a peculiar local or regional popularity which will influence the selection in any school.

For the newer items it is very difficult to predict which will be successful and it may be wise to mention all items of a class without speculation as to their possible value. Such a procedure has been recommended by Professor Terry[9] in a discussion of the "Pharmacy of Organic Substances". In regard to the selection of specific items for discussion Professor Terry's comment will bear repeating: "Good teaching comes in the choice of items to mention."

In conclusion we would repeat that the need for some instruction concerning proprietary medications (or prescription specialties) in the pharmaceutical curriculum has been abundantly indicated by The Pharmaceutical Survey. A method has been outlined for the presentation of such instruction with a minimum of alteration in the pharmaceutical program as it is now constituted in many schools of pharmacy.

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The Dispensing Course: Its Content and Method*

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This subject has been the topic of discussion a number of times at previous meetings of the Conference of Teachers of Pharmacy. It is doubtful, therefore, that any new ideas will be developed in this paper. It will be the purpose of the paper then to review some of the previous writings about dispensing pharmacy and to precipitate a discussion on the subject.

Some years ago Dr. L. Wait Rising reported on "Dispensing Pharmacy in American Universities", a study of the Problems and Plans Committee.[1] His paper was written from data collected by means of a questionnaire submitted to the member colleges and answered in considerable detail by approximately 60 per cent of the recipients. The elementary dispensing course which carried a variety of names from pharmacy to general dispensing pharmacy averaged two class hours and 5 laboratory clock hours for 1.85 semesters. Only two-thirds of the schools reporting gave more

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than the basic training or elementary course. One might conclude from these data that either (a) there is not enough information pertinent to dispensing to require more than one course and therefore those giving advance work are padding the curricula, or (b) the one-third are failing to measure up to the responsibility of their profession. In these dispensing courses the number of prescriptions filled (total for all dispensing instruction) varied from 60 to 1400 and averaged 250. (Undoubtedly these figures included the proprietary prescriptions which may have been only theoretically filled.) If the situation today is anything like the conditions at the time of this survey (1939) further discussion of the dispensing course is certainly in order.

Dean Howard C. Newton[2] presented "An Outline of a Course in Dispensing" in which the subject matter was divided into six parts:

1. **General principles and regular procedures.**
2. **Proprietary preparations.**
3. **Incompatibilities.**
4. **Biologicals, reagents, bacteriological stains.**
5. **Medical appliances, sick-room supplies, etc.**
6. **Advanced practice and review problems.**

In his course emphasis was placed on proprietary preparations and on the development of a good routine procedure in filling prescriptions. He stated that dispensing is the culmination of the pharmaceutical curriculum and that its aims are (a) to facilitate the application of knowledge gained in other courses (b) to bring about the required familiarity with many specific operations and facts connected with this phase of pharmaceutical practice and (c) to develop the technical skill so essential for success in it. He warned against the repetition of material given in previous courses.

In a recent article[3] Dean Newton has discussed the prerequisites of the course in dispensing and the correlation of dispensing with other courses in the curriculum.

A few outlines of the dispensing course and methods of assembling and presenting the material have been presented. Earl

Guth[4] has reported briefly on his course. He recommends small laboratory sections conducted personally by the professor with the aid of laboratory assistants. Students are assigned prescriptions from a file of such size that no more than two students get the same prescription during one laboratory period. This procedure prevents some students from depending too much on their classmates. Guth suggests also a number of other ideas in laboratory procedure.

Leslie Ohmart[5] has given a complete outline of dispensing largely based on the outline presented by Dean Newton.[2] Ohmart has presented also some techniques of teaching the course.

Mitchell J. Stoklosa in his "Laboratory Material for the Course in Dispensing"[6] following the outline of Newton and Ohmart, urges that the laboratory course in dispensing include as many practical pharmacy (drug store) problems as possible. In order to accomplish this objective in providing practical experience whereby the student is afforded the opportunity of applying the fundamental training acquired in the other courses, Stocklosa suggests that the material chosen for the laboratory instruction be varied in character. The material for his laboratory course has been assembled from active prescription files and is constantly being changed by the deletion of prescriptions which prove to have no teaching value and the addition of new prescriptions. A method of keeping records of the prescriptions filled by each student is described. Assignments are made to each student at the beginning of each class and a given group of students will compound entirely different types of prescriptions, that is, all students will not be working on capsules, but rather may be compounding as many different classes of products as there are students in the group. In order that each student may become familiar with the work done by other members of the class, all of the prescriptions are posted on the bulletin board after they are dispensed.

A few of the articles on teaching methods in dispensing might be mentioned. Plein's "Prescription Files and the Teaching of Dispensing Pharmacy"[7] explains how active prescription files can

be utilized in teaching dispensing. This idea has been mentioned previously in Stoklosa's article.[6] The problem of what to do with student preparations after they are graded has perplexed many teachers of pharmacy. If all these preparations are finally relegated to the trash can, some students eventually assume an "I don't care attitude." Plein and Kelly reported in "Correlation of the Teaching of Dispensing Pharmacy and Quantitative Analysis"[8] a method of analyzing certain student preparations. This procedure has created considerable interest among the students in both courses. Joseph B. Sprowls' "The 'Prescription Forum' as a Method of Teaching Incompatibilities"[9] assigns different incompatibilities to each student. When the prescriptions are properly compounded the students discuss their problems in a forum and each student receives the information concerning the group of assignments. This discussion method is indicated also in Stoklosa's paper.[6] L. Wait Rising's "Washington Experiment"[10] described a method whereby selected pharmacies were used as the laboratories for a portion of the students' training. C. Lee Huyck, in a recent editorial[11] expressed his views on an elementary dispensing course in the sophomore year.

The foregoing is not intended to be a complete historical account of the writings about dispensing nor is it intended to review all the teaching methods which have been presented on the subject. These ideas, and perhaps there are more, are reviewed because it is thought that they are good sound ideas which can and should be incorporated into the courses in dispensing pharmacy.

In concluding some remarks should perhaps be presented which will form the nucleus of a discussion from the floor. One remark might concern the elementary course. At present the University of Washington offers an elementary course in dispensing in the sophomore year (which might be better placed in the junior year) and advanced dispensing in the senior year. Other schools have a similar set-up. It appears necessary to have such an elementary course in order that students become qualified for the advanced course where the more specialized procedures are taught.

Nomenclature and/or content of the elementary courses (not necessarily elementary dispensing alone) are sources of difficulty in attempting to assign the number of hours credit which should be devoted to dispensing. A number of colleges teach the elementary dispensing material in courses called by some other name. Even the advanced courses cause some difficulty in naming them. Official Pharmacy, Proprietaries, New Remedies, Organic Medicinals, etc. may all contain similar material and some colleges teach practically all their proprietaries in the dispensing course. It would seem that at least 64 didactic hours and 150 laboratory clock hours are necessary to cover the subject of dispensing. It is claimed that when we institute the five- or six-year course, it will be possible to put the students through these courses more rapidly because they will have had more thorough training in the elementary courses.

Those unusual procedures and prescriptions should be included in the training. Our dispensing courses have been criticized for teaching the manufacture of tablet triturates, but the practicality of such teaching is emphasized when local pharmacists borrow the equipment from the college for such preparation and finally purchase such equipment for ready use.

Laboratory sections should be kept small and they should be supervised with adequate help. Too many times the laboratories are placed in the hands of inexperienced assistants or are left unattended a good part of the time.

The course should include some instruction in proprietaries even though the curriculum includes a course in New Remedies.

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Industrial Pharmacy*

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Industrial Pharmacy, sometimes described as manufacturing pharmacy in its broadest aspects, embraces the various functions that are necessary for converting raw materials into pharmaceutical preparations which are suitable for ultimate distribution to the retail pharmacist for dispensing to the patient, either in original or broken packages. It includes the procurement of chemicals, drugs and packaging materials; the processing of the chemicals or drugs into purer states or into forms especially adapted for medicinal use; and the proper packaging of the finished preparation or product so that it will retain a specified potency while passing through the normal channels of distribution.

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i.e., wholesaler, retail pharmacy or hospital pharmacy and, perhaps, the medicine chest of the patient's bathroom. More recently, this special field of pharmacy has been designated[1, 2] as pharmaceutical engineering.

Regardless of the name or label that is attached to this area of pharmacy, both educators[3, 4] and the people[5, 6] engaged in the manufacturing of pharmaceuticals are generally in agreement that colleges and universities have a responsibility for developing a type of training that would especially qualify their graduates for positions in pharmaceutical manufacturing plants. However, there are considerable differences of opinion among educators and among men in industry concerning the most desirable courses required for an adequate training in this field.

Some educators have expressed the opinion that manufacturing pharmacy is only the development on a large scale of pharmaceutical processes performed by students in a college of pharmacy. They maintain that the training in the fundamentals of pharmacy by most colleges of pharmacy will adequately equip the candidate for a B. S. Degree in Pharmacy for employment in a pharmaceutical plant. Conversely, some men in industry have reported that men properly trained in mechanical engineering or chemical engineering have all the necessary prerequisites for positions in manufacturing pharmacy. In my opinion, the most desirable training for an industrial pharmacist would be the election of specific courses from each of these fields, plus training in new areas of knowledge peculiar to manufacturing pharmacy and not at present included in other curricula. A number of writers on this subject have previously expressed similar opinions. This pedagogic training might advantageously be supplemented by actual experience in industrial plants, a practice long carried out in the field of engineering.

Peterson[1, 2] has suggested that a syllabus in industrial or manufacturing pharmacy include courses in pharmacy and in chemical engineering and their supporting subjects. Some years ago he outlined a curriculum leading to the simultaneous award

of a B. S. Degree in Pharmacy and a B. S. Degree in Chemical Engineering after the completion of a six year program. He justifies the election of basic courses in both fields concurrently because of the difficulties in completing prerequisites for advanced courses in one area of instruction if the student should elect to complete the requirements for the B. S. Degree in the other area of instruction in the customary four years. Although such a combination program should offer an ideal method for training industrial pharmacists, the administration of similar programs in related fields has not proved as successful as had been hoped. The case of the chemical engineer is a good example. Chemists feel that a chemical engineer is not adequately trained in chemistry although they readily admit he may be an excellent engineer. The opposite view is maintained by the engineer. In electing such a combination course, the student's affiliation would constantly be cleaved between the college of pharmacy and the college of engineering or college which administers the courses in chemical engineering. Although the respective colleges in a university may contribute to that unhealthy attitude, it is nevertheless a real condition which impairs the development of the student's program.

Chilson[5] subscribes in part to the six year curriculul proposed by Peterson except that he suggests a more intensive course not burdened with a "lot of academic nonsense" and thus one that would be comprehended in a space of four years. In support of this contention, he cites the record of the Army during the recent war in demonstrating that engineers can be trained "in a period as short as two years by concentrating on engineering and letting the 'cultural' subjects go." Certainly there are few, if any, of us in the colleges that can agree to a greater minimization of the cultural subjects. In fact, most of us heartily subscribe to the recommendation of The Pharmaceutical Survey that our curricula should include more cultural subjects. It is the training in the cultural subjects that distinguishes the university graduate from the trade school graduate. It enhances the capacity of the individual to think more broadly and to make notable contributions, both in the technical and social spheres of his profession.

After carefully considering the various alternatives for preparing an industrial pharmacist, it is my feeling it can best be accomplished by requiring him to elect a B. S. Degree in Pharmacy, followed by enrollment in a properly equipped graduate school. In the graduate school he would be required to major in industrial or manufacturing pharmacy and to minor in engineering. The number of undergraduate courses in engineering which the student might find necessary for supporting graduate courses in engineering could be decreased by the proper choice of electives in the undergraduate pharmacy curriculum. He should not be required to enroll in courses which are specifically designed to meet the needs of the engineer. In my opinion, it is not necessary or desirable for an industrial pharmacist to be a highly trained mechanical engineer or chemical engineer. The larger pharmaceutical plants have assembled men with advanced training or substantial experience in all divisions of plant operation. The small entrepreneur that cannot afford to employ specialists in these several fields surely could not afford to have one man who is adequately trained in all these fields. Consulting organizations are readily available and are widely employed by both large and small pharmaceutical organizations when they desire expert advice in a specific field.

Equally as important as the course work is the completion of a research project in manufacturing or industrial pharmacy. The successful execution of a research project contributes more toward organizing the thinking of a student than almost any other part of his college curriculum. It is this accomplishment that differentiates the graduate degree from the undergraduate degree. The attainments of an M. S. or Ph. D. degree are well recognized in industry. The special benefits of the combination award of a B. S. Degree in Pharmacy and a B. S. Degree in Chemical Engineering have yet to be demonstrated.

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A Graduate Program for Training Teachers of Pharmacy*

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Introduction

What I am about to say will serve, I hope, to focus your thinking a little more intensely on the problem of graduate work in pharmacy. The thoughts expressed will be neither new nor revolutionary. Long ago I learned that there is very little truly original thinking. One may claim credit for a new idea, and frequently does, only to find that last week or last year somebody else gave public expression to the same thing. Also, subconsciously, another man's ideas can be absorbed, later to seep out as children of your own invention.

Thus my function on this panel is to reiterate and recapitulate what has gone before, adding where I can a new stone or a little mortar, to the end that the structure of graduate teaching will continue to have active men working on it. It was Dr. John E. Christian who stated[1] on a similar panel in 1946 that "one of

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the important methods of creating interest and maintaining that interest in a specific topic is to establish opportunity for discussion and exchange of ideas." This is one of those opportunities.

The Need

Before setting up a program of graduate instruction one first establish the fact that it is needed. In education this is not at all difficult. It is axiomatic that in order to teach one must know more than the student. We currently consider, therefore, that instructors of students seeking baccalaureate degrees should themselves be trained beyond that point. Graduate work for the purpose of obtaining that extra training is immediately indicated.

The need in pharmacy can well be rationalized from another direction, namely that a profession is only as good as the people practicing it. We quite generally concede that the stronger professions are those with the stiffest educational prerequisites. Individuals capable of surviving the more severe academic disciplines as a rule stand out among their fellow men. The fact that they have thus achieved is a case for divided praise. To their teachers should go considerable credit. Both background and inspiration come from good teaching. It is the teachers who set the standards for high educational accomplishment and who, in the main, are responsible for significant increases in useable professional knowledge. Education is the foundation stone upon which any profession is built. Therefore those who educate hold the fate of a profession in their hands. It is imperative that their own background be strengthened.

Dean Jenkins once said when urging the expansion of graduate education in Pharmacy[2] "that science is the raw material for power—for a profession." He could well have added that since education fathers science it also is power for a profession. There is no doubt that a profession without benefit of a virile, forward looking, expanding educational system gradually becomes threadbare, ragged, then exposed to the world for what it is, a thinly covered scarecrow supported by a skeleton of poorly articulated, obsolete principles and processes.

Pharmacy is not and will not be in this shabby condition. The importance of being educated is too well recognized by its personnel. This recognition gives force to our efforts in building for improved teachers training.

The Problem

The problem is how best to meet the academic challenge. We, of course, must do the obvious which is to set up a program of graduate instruction designed to furnish better instructors. A number of schools have already done this. My remarks are not directed to them, but to the schools that are contemplating a venture into graduate education.

First in any curriculum arrangement is the formulation of a clear picture of the material that must be taught. Not until the academic objectives are thoroughly understood can the selection and development of courses be logically approached. In the situation under discussion the first question to be answered is "What is pharmacy?" Following as night follows day is its corollary question "What does a professor of pharmacy teach?" History records that the first great confusion was that present at the construction of the Tower of Babel. The second might well be the bewildering number of definitions for pharmacy. Each of us can quickly state our comprehension of the word, but it will almost invariably fail to agree in minor or major degree with that of our colleagues.

Some order can be established from the fact that all the definitions fit into one of two categories (a) broad and (b) narrow definitions. The former are descriptive of pharmacy as a profession, the latter deal with a small academic area within the profession. In substance, the former include all the activities connected with the preparation, distribution, and use of medicines. From the pedagogic angle all the subjects required to teach whatever skills are necessary to meet the varied demands of such a definition are included. Non-departmentalized colleges seem to lean toward the broad view. Staff members are all professors of pharmacy regardless of the nature of the courses they teach.

Departmentalized colleges apparently more readily accept the narrow implications of the word. They ordinarily have four divisions namely, pharmacy, pharmaceutical chemistry, pharmacology and pharmacognosy. Only in the first division are staff members titled professors of pharmacy. As a rule they teach a restricted list of subjects, which grows smaller every time a new survey comes out. Currently the accepted list is made up of general pharmacy, calculations, orientation, laws, and prescriptions. Variation is introduced in the pattern by such courses as cosmetic manufacture, new remedies, hospital pharmacy, and manufacturing pharmacy. These variants are required by some schools, made elective by some, and are not offered at all in others.

Staff members in the other departments generally do not consider themselves pharmacists, rather they are whatever their particular division teaches. In essence they offer service courses to pharmacists, and concentrate on training specialists in their own fields.

In this paper I am holding no brief for either the broad or narrow definition of pharmacy. Each, under proper circumstances, can be justified. There are admittedly occasions where one is more appropriate or suitable than the other. The only reason for discussing them here is to show that when a graduate training program for teachers of pharmacy is being set up, construction must be preceded by a delineating statement on scope. Otherwise there will be no guide and academic paths might wander like some of the streets in Boston.

What is your program going to be—one based on the broad concept of the word pharmacy, or on the narrow definition? There have already been published recommendations for the construction of both types.[2, 3] As my own college is departmentalized I will discuss a graduate program which might be used to train future members of our departmental faculty. Fortunately for the length of the paper Dr. Purdum and Dr. Foss are discussing in separate reports, two important divisions of the department, namely, hospital pharmacy and manufacturing pharmacy.

The Solution

A graduate program is normally divided into major, minor, supporting courses, and thesis research. The major courses serve to deepen the student's knowledge in a given area. The minor and supporting courses contribute to his ability to understand and expand this knowledge. The thesis research tests and develops his ability to do independent creative work. For this purpose the particular field of research is less important than the choice of a problem.

It is obvious that the graduate courses in the major should be so constituted that they represent truly advanced study in pharmacy. That is to say, they must greatly strengthen the student's background in one or more of the courses he is likely to teach. Following the narrow definition these would normally be concerned with fundamental principles and processes, orientation, calculations, hospital pharmacy, manufacturing pharmacy, and prescriptions.

Although the fields are few in number the potential material applicable to a graduate study of each is enormous. For example, the fundamental principles and processes in pharmacy run the gamut from problems in chemical engineering where higher mathematics, physics and chemistry are mandatory to the botanical aspects of cell structure. No one graduate course would serve as a complete background. However, that lack of coverage is not important. Any good graduate course in one of the areas included would set a pattern of study which would supply the student with a learning process he could later use to bulwark his teaching whatever it might be.

A course titled "Advanced Pharmaceutical Processes" might be established. The instructor would not necessarily explore the deeper physical and chemical aspects of a large variety of processes. He could with great profit to the members of his class limit the selection to those he was particularly interested in. He would enthusiastically probe deeper and with more direction into the funges of knowledge surrounding his special interests. Academic matters would be less routine and so take on a glamour

and appeal for the student not possible under less inspired teaching. A love for delving into the reasons why and a desire to explore on one's own would thus subconsciously become a part of each participant in the course. Once the academic pattern is established the technics can be transferred to any suitable subject matter.

By way of illustration the course might deal exclusively with pharmaceutical solvents. Thus all the drug types made by solution and extraction could be studied. The most advanced applications of physics, chemistry, mathematics, engineering and so forth make suitable material for study. Much of this will point the way to fundamental research.

The instructor's interests might lie in the field of emulsions and colloids; they might even be restricted to emulsions and colloids used for a specific purpose *i.e.*, dermatologic application. An excellent one-quarter course could easily be developed which would consider only the problems of manufacture, use, and function of dermatologic colloids and emulsions.

The area covered, remember, is less important than the manner in which it is studied. We are training teachers so our principle objective is to present a method for digging out and understanding the latest pertinent thinking and work at the graduate and research levels.

A number of you in the audience contributed definitions for pharmacy to help define the field for this discussion. Twelve descriptive words kept appearing in these statements. I have grouped them on the basis of similarity of meaning into 6 groups, each of which offers ample opportunity for advanced study and the development of graduating courses. They are

I.	Compounding	IV.	Standardization
	Dispensing		Control
II.	Preservation	V.	Identification
	Storage		Evaluation
III.	Manufacture	V.	Principles
	Production		Processes

Which of these should be developed in your school would be dictated by the special interests of your graduate faculty. It does not follow that these interests will be constant so the nature and direction of your graduate program may undergo considerable evolution over a period of years.

In any program the minor, or supporting courses would logically come from one or more of the following fields plus whatever electives are available at the graduate level in the other departments of your college:—

Botany
Chemistry
Mathematics
Microbiology
Pharmacology
Physiology
Physics
Public Health
Zoology

Thesis research normally would be in the major professor's field of greatest interest. He is better qualified to direct investigation there and should give more personal attention to his students as a result. In our pharmacy department we are working on a graduate set-up where the student will be jointly supervised by all the faculty with professional rank. The advantages as we see them are (1) complete cooperation of the staff on all research (2) more efficient solution to many research problems (3) even distribution of research load.

I have purposely avoided reference to teacher training courses offered by schools and colleges of education as minor subjects in to set proper teaching objectives, and outline good procedures for attaining them, adequate guidance can be had from books or consultation with his education colleagues. If he cannot profit sufficiently from these sources he probably lacks the talent for teaching and should seek an outlet for his training elsewhere.

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Research and Graduate Instruction for Hospital Pharmacists*

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Is there a need for graduate instruction in hospital pharmacy? The graduate of the four year course in pharmacy is not as well prepared to operate a hospital pharmacy as he is to manage a drug store. Even though the schools train personnel primarily for the retail pharmacy, few graduates could leave the university, enter drug stores and operate them successfully. The new graduate is even less well fitted for hospital pharmacy. Further specialized education and on-the-job training is necessary before the pharmacist can properly qualify as a hospital pharmacist. Hospital administrators are rapidly becoming aware of this and are seeking pharmacists who hold graduate degrees and who have had special training in hospital pharmacy.

Many pharmacists already engaged in the practice of hospital pharmacy are in need for further training to keep them abreast of modern developments. The necessity for this training has been recognized by the American Hospital Association for several years. The problem has been met through the medium of institutes conducted by the Association in cooperation with the American Pharmaceutical Association and the American Society of Hospital Pharmacists. Three such institutes have been held during the last three years. Enrollment was limited by physical accommodations and many interested pharmacists were turned away. To rectify this condition, two institutes will be held during 1949 in widely

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separated sections of the country. In addition to these, a third institute sponsored by the Catholic Hospital Association will be held in another locality.

The fact that some eight or ten of our schools of pharmacy now offer graduate instruction in hospital pharmacy is good evidence that there must be a growing interest and a growing need in this field. In several of these schools, the graduate work is combined with an internship in a hospital. The number of internships available do not begin to satisfy the demand. For example, a combined two year internship-graduate study plan is offered jointly by the Johns Hopkins Hospital and the University of Maryland, in which three appointments are made annually. This year, we have had in the neighborhood of fifty applicants for the three available openings.

There is no question that the profession can absorb many more personnel than our schools can train for a number of years to come. Taking into account present hospital facilities plus the vast expansion program under way as the result of the Federal Hospital Survey and Construction Act, it has been estimated that we will need from 17,000 to 22,000 hospital pharmacists in the next five to ten years.

In establishing a graduate curriculum in hospital pharmacy, consideration must be given to the requirements of the individual student. Wherein is the undergraduate course inadequate? The answer to this question will vary from school to school. During the last two years, I have had personal experience with seven interns from six of our accredited schools of pharmacy of whom four had had no course in manufacturing pharmacy, four no biochemistry, and none a course in hospital pharmacy. Because of this condition the graduate curriculum must be flexible as to courses offered in order to fill in gaps where specific needs exist. In some cases, students may be required to take certain undergraduate courses without credit when these are necessary prerequisites for desired graduate courses.

The Curriculum

Major Courses	Credits Didactic	Laboratory	Total
Hospital Pharmacy Administration	3		3
Pharmaceutical Manufacturing	2	4	6
Parenteral Solutions Manufacturing	1	2	3
Advanced Pharmaceutical Technology	2	4	6
Pharmaceutical Literature	2		2
History of Pharmacy	2		2
Pharmaceutical Seminar (during 4 semesters)	4		4
Pharmaceutical Research		6	6
Minor Courses			
Physiological Chemistry	4	4	8
Advanced Pharmacology and Therapeutics	4	2	6
Biological Assaying	2	2	4
Advanced Bacteriology	2	2	4
Serology and Immunology	2	2	4
Public Health	2		2

The course in hospital pharmacy administration is intended to give the student an overall picture of hospital pharmacy practice, emphasis being placed on those functions and procedures which differ from the practice of retail pharmacy. Two separate but similar outlines for such a course have appeared in The Bulletin of the American Society of Hospital Pharmacists during the last year.[1] The course should be taught by an experienced hospital pharmacist. Important items for consideration include hospital organization and management, the application of Federal and State laws and regulations to the hospital pharmacy, accounting procedures, charges for drugs, purchasing, inventory records, the pharmacy committee and the hospital formulary, interprofessional relations, and hospital pharmacy standards and the accreditation of the hospital pharmacy.

A knowledge of hospital organization and management is essential in the successful practice of hospital pharmacy. In the retail drug store, the pharmacist is constantly in direct association with the customer or patient. In the hospital, the pharmacist rarely has a direct contact with the patient. His dealings are with

the hospital administrator and with representatives of all other hospital departments. For this reason, an understanding of the organizational structure of the hospital is a necessity.

In the usual course in pharmaceutical jurisprudence, emphasis is properly placed on those regulations affecting retail pharmacy. The corner druggist is not concerned with regulations controlling tax-free alcohol, whereas a thorough knowledge of these are most important to the hospital pharmacist. Another example is the marked difference in the handling of narcotics in retail and hospital pharmacy.

Charges for drugs have been mentioned above. It is not uncommon for a hospital to employ as many as three or four pricing schedules for charging drugs and related supplies to other departments and to several categories of patients.

Attention must be given to the functions of the pharmacy or therapeutics committee and to the compilation and use of the hospital formulary. Both play a big role in providing proper medical care for the patient and economical operation of the pharmacy.

Hospital pharmacies in general engage in pharmaceutical manufacturing to a greater degree than do retail drugs stores, and the necessity for such a course becomes obvious. There is no real need for a separate course in the manufacture of parenteral preparations if this field is covered adequately in the course in pharmaceutical manufacturing. Parenteral manufacturing is listed as a separate course because I believe that it is given insufficient attention in the usual course in manufacturing pharmacy.

Advanced pharmaceutical technology is described in the University of Maryland catalog as "A study of pharmaceutical manufacturing process from the standpoint of plant; crude materials used; their collection, preservation and transformation into forms suitable for their therapeutic use." During the last two years, I have used this course as an introduction to research with our

interns and it might be more properly named "Special Problems in Hospital Pharmacy". Some of the seemingly simple problems assigned have developed into the major research of the students involved and worthy of the master's thesis.

History of pharmacy is not essential to successful practice but it is desirable to give the student a better cultural background for his profession.

Pharmaceutical seminar should be required during the entire period of the student's enrollment in the graduate school. When the student is also interning in a hospital pharmacy, a combined seminar and pharmacy staff meeting will prove advantageous to both student and staff pharmacist.

Pharmaceutical research culminating in a thesis is a must. In the practice of hospital pharmacy, problems arise every day, the answers to which cannot be found in the library. Therefore, it is important that the student be trained to think for himself. Many of the problems are not specifically those of hospital pharmacy and their answers are of value to retail and manufacturing pharmacists. New product formulation requires a considerable amount of attention. Among the problems currently under study by our graduate students, the following are typical:

1. **A study of the solubility of voltile oils in distilled water. This was undertaken with a view toward reducing the quantity of oil used in the preparation of official aromatic waters and the elimination of filtration. The study includes the addition of certain surface active agents to the waters.**

2. **The stability of aqueous solutions of scopolamine hydrobromide. The psychiatric department of our hospital employs appreciable quantities of these solutions and the preservative used in the past has not proved satisfactory. The present study embodies the periodic assay of buffered solutions preserved with benzalkonium chloride.**

3. **A study of the sterilization and stability of atropine sulfate solutions.**

4. **The relative efficacy of instrument sterilizing solutions. Numerous formulas for these solutions have appeared in the literature and each is claimed to be superior to others. Several are in use in our hospital and we would like to standardize on one.**

5. The manufacture of compressed tablets from a mixture of the potent medicament in powdered form with a previously prepared sucrose-lactose granulation. It has been proposed in the literature that the manufacture of tablets can be simplified by preparing many kinds from a single granulation where the proportion of active material is small when compared with the total weight of the tablet. The question arises as to the uniformity of the mixture and amount of separation of powder from granules in the shoe of a single punch tablet press. Experiments thus far indicate that there is great variation in the amount of active ingredient in tablets so prepared and that the procedure is not to be recommended.

Physiological chemistry should be a required minor subject if the student has not had this course on the undergraduate level. In the large hospital, the pharmacist is usually called upon to prepare and supply various qualitative and quantitative reagents for use in the clinical laboratory. In the small hospital, he is sometimes placed in charge of the laboratory in addition to his duties in the pharmacy.

The hospital pharmacist must have a thorough knowledge of the actions and uses of drugs. More and more the staff physician as well as the visiting physician calls upon the pharmacist for therapeutic information. Further, the schools of nursing in many hospitals engage the hospital pharmacist to teach the course in pharmacology to student nurses. For these reasons, more than a basic knowledge of pharmacology is needed and graduate courses are the answer.

The Intern Training Program

It appears to be well agreed that a period of internship in a hospital pharmacy is a very necessary part of the education of the hospital pharmacist. There is a difference of opinion among hospital pharmacists and among educators as to when the student should serve his internship in relation to his graduate studies. Some feel that the internship should precede while others contend it should follow the course work leading to a Master of Science degree. It is my opinion that the two should run concurrently during a two year period. In this way the student-trainee will have two years of association with fellow graduate students and two years of association with hospital pharmacists and other

hospital personnel—even though each have been on a part-time basis. One prominent hospital pharmacist has proposed that the student take six months of training in a hospital pharmacy followed by a year of graduate study leading to the M. S. degree, and this followed by another six month period of internship. This suggestion has been made with the thought that during the first six month period in the hospital,* the student will realize his inadequacies and appreciate the need for graduate study. During the final six months of the internship, he can put into practice the theoretical knowledge gained during his advanced course of study

Internships are offered by many hospitals but there is no apparent uniformity in the training given. Not many years ago, some such programs were condemned as a means of obtaining cheap help for a hospital pharmacy with little or no regard for benefits to be derived by the trainee. All such plans in existence today with which I am familiar are offered by well qualified persons who are sincerely interested in producing grade A hospital pharmacists.

The Minimum Standard Committee of the American Society of Hospital Pharmacists has drawn up a detailed outline for on-the-job training of the hospital pharmacist. The outline has been published in The Bulletin of that Society.[2] The Society is now working toward the adoption and enforcement of these standards by a suitable accrediting body, possibly the Division of Hospital Pharmacy of the American Pharmaceutical Association. These standards call for a minimum training period of 2100 hours in the following subdivisions of the pharmacy department:

1. **Out-patient prescription laboratory** ..... **350 hours**
2. **General dispensing laboratory** ..... **525 hours**
3. **Manufacturing laboratory** ..... **700 hours**
4. **Administration** ..... **525 hours**

The outline also gives the detailed duties and responsibilities of the trainee in the several sub-departments.

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Edward Parrish, A Forgotten Pharmaceutical Reformer*

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If we agree that history is not merely the collection and presentation of more or less connected facts and names, but an investigation into, and an interpretation of, the interplay of men and forces responsible for a certain development and turn of events that we have to face, then one question becomes acute. The question that arises is—Why is it that among a number of important contemporary individuals, it is one man in particular, or a few selected ones, that posterity credits and even identifies with a special development? In other words, why are some remembered and the others forgotten?

To apply this question to the case under consideration: There were three men among the galaxy of men of knowledge, talent, and character who, in the second half of the nineteenth century, dug the channel into which the various isolated brooks could be directed and made to form the river,—"The American Profession of Pharmacy." The three men to whom this big task offered the most immediate and pressant challenge were William Procter, Jr., (1817-1874), John Michael Maisch (1831-1893), and Edward Parrish (1822-1872).[1]

To William Procter, Jr., grateful posterity has given the sweeping title of "The Father of American Pharmacy." John Michael Maisch has been recognized as the "father of adequate pharmaceutical legislation in the United States of America."[2] No cognomen of such a kind has ever been bestowed upon Edward

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1This date of birth (May 31, 1822) is given in most of the obituaries of and references to Edward Parrish. Sometimes the date 1820 is found.

2George Urdang, The Fiftieth Anniversary of the Death of John Michael Maisch, **Am. Journ. Pharm.**, 116 (1944): 9.

Parrish. If one looks on the life dates of the triumvirate, the fact becomes evident that Parrish dates place him in between his competitors for lasting fame. He was born after Procter and before Maisch and was survived by both. He was "in between" these men throughout his life.

The basis from which the activities of this triumvirate grew into national importance was the Philadelphia College of Pharmacy, and the medium through which their ideas and work was spread and became influential was the American Pharmaceutical Association.

The five years which William Procter, Jr. was older than Edward Parrish gave the former his first advantages. He graduated from the Philadelphia College of Pharmacy in 1837 and four years later, one year before the graduation of Edward Parrish in 1842, was already acting in the responsible position as secretary of the committee of the college on Revision of the United States Pharmacopaeia. In 1846 Procter became professor of pharmacy at the college, the first pharmacist in the United States to occupy such a chair, while Parrish, in order to find an outlet for his teaching talents and ambitions opened, in 1849, in the rear of the pharmacy which he had established in 1843, an institution for the instruction of medical students in pharmacy, which he called "The School of Practical Pharmacy." As successful as this school was, it is understood that it was looked at with some suspicion by his colleagues.

The same held true for the work that has done the most to preserve the name of Edward Parrish for posterity, namely, his "Introduction to Practical Pharmacy," the first edition of which appeared in 1855. Again Parrish was a second to William Procter, Jr., who had published his Mohr-Redwood's "Practical Pharmacy" in 1849, and he had transgressed the limits of pharmacy proper by adapting his book to the needs of the self-dispensing physician rather than to the pharmacists proper. Like its author, the book was not denied recognition and was even praised. The praise, however, was given with obvious reserve and reservations.

It is not without a touch of irony that the candidacy of this self-styled teacher of medical students for the chair of materia medica at the Philadelphia College of Pharmacy in 1850 was refused for his lack of training in medicine,[3] and that he had to wait another 14 years until in 1864 he reached his goal. Only two years later, in 1866, William Procter, Jr., resigned his professorship in order to create a place for J. M. Maisch. This was a practical as well as ideological acknowledgement not granted by him to Parrish. It was merely through an exchange of chairs with Maisch that Parrish finally, in 1867, became a teacher at the Philadelphia College of Pharmacy of the subject which he considered his specialty—the theory and practice of pharmacy. It had been, by the way, through Maisch, that in 1859-1860 an attempt had been made to make Parrish's School of Practical Pharmacy a kind of supplement to the Philadelphia College of Pharmacy, offering analytical courses "designed in particular for the wants of pharmaceutists."[4]

It is very significant that Parrish never obtained any decisive influence over the journal published by the Philadelphia College of Pharmacy, the *American Journal of Pharmacy*. He was, together with some others, after 1851, a member of the publishing committee. But beginning in 1850, William Procter, Jr., held the editorship firmly in his hands for more than two decades, yielding it in 1871, not to Parrish, but to Maisch.

This honorable back seat place, so obvious in the part played by Edward Parrish in the Philadelphia College of Pharmacy, was his lot likewise in the American Pharmaceutical Association. Here too he made himself heard again and again and was given all attention and respect possible. But the direction of the new national pharmaceutical movement in the United States of America was determined by others, primarily by William Procter, Jr., and John M. Maisch.

"The Convention of Pharmaceutists and Druggists," held in the City of New York on October 15 and 16, 1851, was not at-

[3]Am. Journ. Pharm., 45 (1873): 225.

[4]Kremers-Urdang, History of Pharmacy, Philadelphia 1940, p. 208.

tended by Edward Parrish, and it was William Procter who went from Philadelphia to New York with the firm intention to make this gathering the vantage point for more than a satisfactory solution of the problem of the import of adulterated drugs, *i.e.*, for a permanent national pharmaceutical association. He saw his plan realized at "the National Pharmaceutical Convention," held at Philadelphia one year later, (October 6 to 8, 1852). The delegates from the Philadelphia College of Pharmacy officially representing the college at this convention were David B. Smith, Charles Ellis, and William Procter, Jr. Edward Parrish was one of the men, "invited to seats in the Convention."[5] It is understood that he immediately joined and very actively participated. But again he was a second, not the first man.

As far as high offices in the A. Ph. A. were concerned, the picture is similar. William Procter, Jr., was selected president for the period 1862-63, and John M. Maisch became first vice-president for 1863-64. In all probability Maisch would have advanced to the presidency, had not in 1865 the confidence of his colleagues made him the incumbent of a position, the creation of which has had the most favorable effect on the development of the young national organization, and, therefore, on American Pharmacy. He was made permanent secretary of the American Pharmaceutical Association. It was three years after Maisch became first vice president that Parrish was elected to that position in 1866, and it was six years after Procter was elected president that Parrish was elected to this highest office of the American Pharmaceutical Association. Procter like Parrish being of old Anglo-Saxon Quaker stock, the precedence of the former over the latter was a competition among brethren. With Maisch, the rather recent immigrant from Germany, it was different, and it proves the metal of Parrish that his good relations with Maisch remained undisturbed.

Is the statement that at his time there was no one who gave to American pharmacists so many incentives and outlooks, so much to think about as Parrish, incompatible with this honorable

[5]**Am. Journ Pharm.**, 25 (1853): 3.

back seat occupied by him in the shaping of the future of American pharmacy in this decisive period, or incompatible with the kind of recognition accorded to him by his contemporaries and posterity? By no means! The suggestions of the backseat driver, although they may be good, are usually taken with some impatience. Nevertheless, if they are followed, they may bear fruit later on.

In the following a brief summary is given of the most important incentives, opinions, and statements voiced by Parrish in the annual meetings of the American Pharmaceutical Association:[6]

1. *Pharmaceutical Statistics.* It was on the basis of a resolution presented by Parrish at the organization meeting in 1852 that the fundamental attempt was made "to obtain data on the number of Apothecaries and Druggists in each of the principal Cities and Towns of the United States," their organizations, professional character, separation from medicine, and state laws concerning pharmacy.

2. *Pharmaceutical Legislation.* In 1852 "Mr. Parrish . . . regretted the disposition to turn our energies in the direction of legislation, instead of looking mainly toward self-improvement and the general elevation of our profession." Seventeen years later, in 1869, in his capacity as president of the Association, Parrish recommended "a law to regulate the practice of pharmacy and the sale of poisons and to prevent the adulteration of drugs and medicines," as drafted by the committee under Maisch. "Originally opposed to any attempt," Parrish states, "to prevent by legislation the evils which are so perceptible under our present unrestrained system, I have gradually arrived at the conclusion that the effort should be made now to exhibit to the Legislatures of the several States such a law as, if it could be carried out, would be of immense advantage to the public, and would at once place Pharmacy in its true position . . ."

[6]The following quotations are taken from the respective annual Proceedings of the American Pharmaceutical Association.

3. *Membership, Restriction and Fees.* In 1854, Procter warns the Association against making the discontinuance of the sale of quack medicines a prerequisite for membership. "It is," he says, "mainly by the sale of quack medicines that many druggists subsist, who yet desire a reform in their business, and would be glad to cooperate in the laudable objects of the Association." It was in realization of this fact that at the 1855 New York meeting of the American Pharmaceutical Association the obligation to subscribe to the Code of Ethics as a prerequisite for membership was dropped.

In 1859 Procter fought again for the inclusion of as many retail pharmacists as possible in the national association in order to subject them to the beneficial and ethicizing influence of this organization. His main opponent was Dr. E. R. Squibb. "Instead of opening the door wider," the latter said, "the time has in reality come when we should narrow it."

In 1867 Parrish opposed the suggestion of higher fees. "The objection to taxing is," he said, "that those persons we most desire to associate with us are discouraged from joining the Association on account of the Fees."

4. *Broader Connections.* It was through adoption of a resotion by Parrish that, in 1855, the election of *honorary members* was legitimized, and in 1867 the participation of delegates of the American Pharmaceutical Association in *international pharmaceutical congresses* was decided upon at the suggestion of Parrish. The year after, Parrish expressed his satisfaction by stating that, in his opinion, "it is a cause of congratulation that we have been represented in a Congress of Pharmacists."

5. *Drugmarket.* In 1862 Parrish pointed to the danger "of treating the subject of adulteration too far." His resolution to replace the "Committee on Adulteration" by a "Committee on the Drugmarket" the task of which should be "to report annually the fluctuations in the supply and demand of drugs, the variations in quality, and adulterations and sophistications . . ." was accepted.

6. *Pharmaceutical Education.* In 1866 Parrish admonished the Association to "exert its influence to improve the condition and extend the appreciation of the colleges in the United States and to establish others when practicable . . . That is the way in which to raise the status of pharmacy in the United States."

In an essay on "The Preliminary Education of Apprentices," prepared shortly before his death for presentation at the 1872 meeting of the American Pharmaceutical Association and read by William Procter, Jr., Parrish made the following, for his time almost incredible, statement: "A youth who could spend a year or two in college at these general studies before entering on his business education, would come forth beyond comparison to the average candidates for the pharmaceutical profession . . . What is most needed in pharmacy, is a higher degree of preliminary education . . ."

7. *Incorporation of the American Pharmaceutical Association.* subject of an act of incorporation for this Association . . . be In 1859 "on motion of Edward Parrish it was voted that the referred to a Special Committee with power to use the necessary means to obtain such an act from Congress."

It was significant of Parrish that it was general considerations that occupied his mind and caused his actions, and it is for this reason that he mostly lacked the steadiness of pursuit of one and only one problem that was up for discussion. When during the American Pharmaceutical Association convention of 1869 under his presidency the question of an adequate title for the members of the pharmaceutical profession was discusse, Parrish suddenly interrupted the sober discussion by raising the question "Who are we? What are we?" and giving it an eloquent answer, starting as follows:

"To a limited extent, chemistry, applied, is pharmacy. All the innumerable wants of society, all these details, all these minor considerations in domestic economy, belong to us. They are our profession, for we are a profession; they are our art, for we practice an art . . ."

In the *American Journal of Pharmacy* and in the *Proceedings of the American Pharmaceutical Association*, Parrish published a number of articles, exceedingly well written, which offer ideas that might have been cherished but hardly realized by his colleagues. His essays "American Pharmacy" and "Ethical Analysis" in Am. Journ. Pharm.; *26* (1854) and *30* (1859) respectively, his "Pharmaceutical Notes of Travel" in the same journal, *31* (1859), his protest entitled "A Plea for the Handmaiden" against the claim by physicians of superiority over the pharmacists and "the favoritism executed by them," published in the A. Ph. A. Proc., *11* (1863), are still inspiring through their eloquence, the daring frankness of expression sometimes carrying the charm of an improvised confession, and the originality if not even peculiarity of his ideas.

In our day of discussion of a professional Doctor title for pharmacy it is interesting that Parrish in 1871 wrote the following:

"A degree of Doctor of Pharmacy seems appropriate to place our profession on a par with those of medicine and of dentistry. . . . A title of this kind would hardly seem pretentious if held in reserve by the Colleges until their graduates had attained a well recognized professional standing, and the prospect of attaining it would be an honorable incentive to professional effort."[7]

Well meant, still better sounding and, in their original form, practically impossible, were the characteristics of many ideas of Parrish and it is not astounding that his colleagues considered him with a mixture of respect and tension, that they looked at the inspiring effect of his eloquence with suspicion and even some fear.

It was in non-pharmaceutical circles and activities that Parrish rose to leadership. One of his most consequential deeds was his decisive participation in the founding of Swarthmore College by the Society of Friends. When, "largely owing to his personal exertions" throughout the years the building was completed in

[7]Am. Journ. Pharm., **43** (1871), 535.

1868, Parrish was officially declared the first president of Swarthmore College and continued in office during nearly two years. In a report of the managers of that institution issued after his death the following is said:

"By conversation in that wide circle of Friends in which he moved, and where he was so much beloved, by extensive correspondence, by public addresses, and by his work entitled "Education in the Society of Friends," he did much to arouse attention to the importance of establishing among us an institution for higher culture—culture not of the mind alone, but of the heart as well . . ."[8]

It was, finally, likewise a mission of his conviction and his heart, on which he, on September 19, 1872, found his early death having reached an age of only fifty. He had accepted an appointment by the Government to settle some difficulties with certain Indian tribes, places under the supervision of a committee of the Society of Friends. While in discharge of this duty he fell a victim to the "miasmatic fever" of the area concerned.

The obituary read by William Procter, Jr., at the meeting of the Philadelphia College of Pharmacy of March 31, 1873, more than half a year after the death of Parrish, covers six pages in small print.[9] It lists conscientiously all the stages of his career and gives full credit to his merits. But it does not conceal the critical objections which Parrish's colleagues had against him, whereby it sometimes is diffcult to decide where the praise ends and the reproach starts. The following quotations may prove this:

"The tendency of his [Parrish's] mind may be seen by a glance at the papers—but few on physical or chemical investigation, the greater part being such as could be written by reflection and study, without experiment. His ready pen was always at command to bring together in order the results of reflection and

[8]Am. Journ. Pharm., **45** (1873): 229.

[9]Ibid: 225-231.

inquiry, whether these related to the ethics of pharmacy, the by-laws of the Association, or the advantages of education, general or special. . . .

"Professor Parrish was by nature ambitious of distinction among his fellows, yet his yearnings after power or place were influenced by a spirit at once mild, benevolent and lovable. His intellect, which was clear and forcible, he had cultivated by reading and conversation. Had it been steadily concentrated in the line of his profession, it would have led him to honors far higher than those to which he attained; but by directing his attention to too many objects, his efforts lost in power and thoroughness what they gained in variety and popularity."

At another place of the obituary it is stated that "Professor Parrish was always popular with the students; his free and open manner, the interest he took in the class individually and collectively, and, above all, his good delivery as a speaker, rendered him a favorite and gave him influence." This statement is confirmed by a resolution of the Alumni Association of the Philadelphia College of Pharmacy.

"To this community," the resolution says, "in which he has so long labored and maintained an untarnished reputation, where indelibly are written the marks of his earnestness, integrity, philanthropy and public spirit, his memory will long be green.

"The graduates and students of the College will sorely miss their genial, warm hearted and fatherly teacher, who was so approachable and so readily entered into sympathy with them in the difficulties that beset their paths."[10]

A forgotten pharmaceutical reformer but an unforgettable human being who set himself a monument in the hearts of those who needed sympathy and understanding—that was Edward Parrish, the third wheel on the gig of American pharmacy between 1852 and 1873, which rested mainly on William Procter, Jr., and John M. Maisch.

10Amer. Journ. Pharm., **44** (1872): 471.

The President's Page

There is a tendency today on the part of colleges to give undue emphasis to the materialistic and the practical aspects of the profession. Such instruction is necessary because we are a working people and we must make a living. It is essential that we give a great deal of attention to material things and we must recognize that we are living in the present.

However, there is another side to life which also merits consideration. It has been said that a successful man is one who leaves the world a little better than he found it. It behooves all of us, therefore, to give some consideration to the future. This means that we must think and plan and build. In order to plan and build we must have a vision—a picture of what the finished structure may be. Roger Babson said a few years ago that the world needs a spiritual reawakening, a more faithful observance of the Golden Rule, and a revival of character consciousness.

Again there is often much comfort and encouragement in thinking and planning for the future—building castles in the air. Many important inventions and progressive movements are the result of imaginary visions. Many men have made great contributions to humanity through building castles in the air. If pharmacy is to progress, the members of the profession must have ideals and must strive to achieve those ideals. "Man's reach should exceed his grasp, else what's a Heaven for."

In "Basic Material for a Pharmaceutical Curriculum" it is pointed out that one of the important duties of a pharmacist is "to recruit young men of character for the profession." Pharmaceutical educators should be vitally interested in this because they not only recruit but prepare young men for this profession. Board members should also be just as vitally interested because as board members they must examine the produce of the colleges and admit them to practice, that is, they must pass on the job of the educator and either approve or disapprove. The practical pharmacist should be interested because after the colleges have graduated these pros-

pective recruits and the boards have placed them, the practical pharmacist takes them in his pharmacy and polishes them off to varying degrees of satisfaction and practical efficiency. The general public should be deeply concerned because it is these same recruits that the public must look to for a safe and satisfactory pharmaceutical service. Consequently, it is evident that "Recruiting for the Profession of Pharmacy" is a problem which extends down into the very roots of society and covers the length and breadth of our nation.

What is character? Character is what we are and what we will do in our daily lives and vocations and how we will react under unusual situations. Character involves such attributes as loyalty—loyalty to one's self, to associates, and to the profession. Loyalty to the profession implies confidence and faith in the principles and practices to which the profession is committed. Character also includes honesty and honor. What is honor? It has been said that honor is "what is left when no one is looking."

What can the colleges do concerning these attributes of character? What can the pharmacists in practice do concerning character in the practice of the profession? We must give serious thought to the future of our profession. Pharmacy, as does every profession, needs young men of character to safeguard and enhance the future of pharmacy. Now here is the real question that demands the careful and serious consideration of every pharmacist and every pharmaceutical educator: "Is the practice of Pharmacy on a level and of such nature that it will attract young men of ability and character in the future? Will young men of character and ability be attracted to Pharmacy?"

Bernard V. Christensen,
The Ohio State University

The Editor's Page

On a previous occasion, attention has been called in these pages to the establishment by the legal profession of the *Journal of Legal Education*. With the appearance of its first issue, the Editor of that journal requested an exchange with *The American Journal of Pharmaceutical Education;* for, he said, he had discovered that the various professions had many problems in common. No one who has not read that journal and the various educational journals published by the various groups within the area of the health sciences can possibly appreciate the truth of that statement, and those who have read them are amazed at the magnitude of our common problems. One is also impressed by the fact that no profession, including law, is satisfied with its educational program.

In a recent issue of the *Journal of Legal Education* (Winter 1949, Vol. 2, No. 2) is an article written by Prof. Kenneth Robert Redden of the College of Law of the University of Virginia, and Mr. Edgar Allan Jones, Jr., founder and first editor of the *Virginia Law Weekly* (1948-1949), and entitled "Extra Curricular Activities—The Ugly Duckling." As one reads the article, which is pregnant with good common sense, the feeling develops that the title would have been more appropriate had the word *"Neglected"* been used instead of *"Ugly."* The authors state that "The basic purpose of legal education, to instill in the embryonic lawyer high ideals and then develop his legal applicatory skills to serve them, has not changed from the day Thomas Jefferson first instituted a program of professional preparation for law in this country at the College of William and Mary in 1779." The authors call attention to the fact that through the years a pedagogical war has been carried on as to the best methods of achieving these results. There are still differences of opinion. Nevertheless, educators are convinced that something more than book knowledge and know how is necessary if he is to "become a professional man worthy of this trust, to say nothing of his hire." There are certain other attributes he must possess. "Among these qualities are integrity, initiative, poise, industry, self-reliance, imagination, willingness to assume responsibility, ability to organize and execute a plan of action in one word, *"leadership."*

There are certain activities that are "curricular." The authors define such activities as those for which *course credit* is given. In this article such activities are not considered. Only those are considered which are extracurricular, which the students conduct, and for which they are responsible. These include legal periodicals (law reviews); legal fraternities, which although they may be primarily for social purposes may sponsor prizes, scholarships, etc.; experience in organizing and conducting student self-government bodies; organizations intended to introduce students to the professional problems they will meet after admission to the Bar; law school forums; problems which will require research in law practice; book reviews and comments; debating clubs; moots courts and many other activities which develop in the student qualities necessary for moral, intellectual, professional, and civic leadership. The authors then conclude, "The American bar is by heritage and practice better equipped than any other group for leadership in a democracy. It would therefore seem to follow that law schools should broaden their outlook and training in order to make their graduates better lawyers and more effective leaders in society. This may be accomplished in part by a co-ordinated extracurricular program, the theretofore ugly duckling of legal education. Any school which has not or will not consider these activities as an important part of its program is not properly discharging its responsibility to its students. And it takes a man of exceptional character to overcome in later life the handicaps of an inferior education."

Anyone who reads can see how law education and pharmaceutical education parallel. The same is true of other areas of professional education. The final sentence in the article quoted above might well be emblazoned on the door of every class room and every laboratory in every institution giving pharmaceutical instruction, to the benefit of both teacher and student. "It takes a man of exceptional character to overcome in later life the handicaps of an inferior education" applies to an institution, to a program of education, and to professional practice just as truly as it does to an individual. Pharmacy is today suffering the pangs of such an inferior educational program. This should give those who are

opposing the implementation of The Pharmaceutical Survey something to think about and perhaps do some acting instead of just thinking.

Mr. Rand P. Hollenbeck, Grand Secretary of Phi Delta Chi, is to be commended for his effort, in a series of bulletins addressed to local chapters and alumni, calling attention to the serious situation which has developed in some, if not all, of our colleges and universities due to the almost universal custom of imbibing alcoholic liquors in lesser or greater quantities, and leads eventually to various types of tragedy, including murder, such as occurred recently at Ohio State University and the State University of Iowa. When such incidents occur, if a member of a fraternity group is involved, the public is sure to condemn the fraternity, although the fraternity was in no way responsible. Secretary Hollenbeck tells the members of his own fraternity that when such an incident makes the pages of the New York Times, it has become a matter of national importance. He reminds his fraternity brothers of the pledge they take when they join the fraternity to the effect that they will neither drink intoxicaing liquors in the fraternity house nor bring them there for others to drink, and commends them for the fact that in the thirty years he has been in the fraternity he has never seen a sip of an alcoholic drink of any kind taken in any of the fraternity houses. Then, as if remembering the frailties of human beings, he adds, "Of course, that doesn't mean that it might not be there." Secretary Hollenbeck also warns against the presence of too many fire arms present as souvenirs or otherwise in our fraternity houses in these post war days. However, guns may be useful on occasions, but alcohol is the basic factor responsible for these crimes. The time has come for the profession of pharmacy to free itself as a public health profession from the taint of alcoholism.

One of the most inspiring and hopeful signs of our time is the tremendous number of new books in the pharmaceutical and related fields that have been rolling from the presses in these post war days; and the scientific and educational journals are the recipients of more high class articles than they can find funds to

print. This is a wholesome situation, and is proof that pharmaceutical education and practice is no longer static. For a long time there has been a need of competition in text book writing. In performing this task, something more than competition with oneself is necessary. It is competition between competent authors in the same fields that results in improvement. Then too, there are other fields in pharmacy where the material has scarcely been touched in text book form.

I am often reminded of a statement once made by Mr. Ellis W. Bacon, then director of the medical textbook division at the Lippincott Company, to the effect that a poor text book on a subject was better than no text book at all. For, if you have a poor text book, you have something to stimulate improvement. Credit should be given The Pharmaceutical Survey for the innumerable hypodermics it has given to improve our pharmaceutical literature, and nothing should be left undone to encourage our young men who are best qualified to write our teaching texts to devote at least a part of their time and talents to that activity. Often the complaint is made that it is impossible to get publication. Publishers are not asleep. When a better text is written, there will be a publisher waiting.

Time passes and so do men, but not their accomplishments. What they stand for becomes a part of the current that continues to flow on down through the centuries. Clair Albert Dye was a quiet, unassuming man with a scholarly mien and possessing a dignity which was always maintained. He had the respect and the affection of all that knew him, whether scholar, student or the man in the street. In the struggle for an adequate and dignified educational program for the practice of pharmacy, he was always to be found in the front rank. When it came to a vote on basic matters necessary for progress, no one asked where Dr. Dye stood. All knew before the vote was cast. Another pioneer in the ranks of pharmaceutical educators has passed, but his presence will continue to linger in the minds of his colleagues, an inspiration to carry on.

RUFUS A. LYMAN

Gleanings from the Editor's Mail

The faculty of the School of Veterinary Medicine at Michigan State College sincerely appreciates the copies of The Journal that are coming to us at the request of the American Foundation for Pharmaceutical Education. We appreciate this courtesy a great deal, and I can assure you that The Journal will be utilized to its utmost by our faculty and in part by our students.

I hope that you will send our thanks on to the American Foundation for Pharmaceutical Education.

Very truly yours,
C. S. BRYAN, Dean
Michigan State College
School of Veterinary Medicine

East Lansing, Michigan
January 30, 1950

As you are undoubtedly aware through correspondence with Dr. H. Youngken, Jr., the department of pharmacognosy here at Washington is anxious to contribute to the admitted need of reorganization in its area of pharmaceutical training. As a consequence, we have taken the initiative in attempting to define and more clearly delineate both the undergraduate and graduate curriculum of pharmacognosy. Feeling that only by continued efforts to promote discussion of the matter can we hope to effectively revamp this field, both Dr. Youngken and myself have sought opportunities to stimulate thinking in terms of new concepts in the field.

Throughout my graduate training and teaching efforts it has been my conviction that pharmacognosy's most important role in teaching and research is the part it can play in describing to the student how natural substances influence or contribute to our current synthesis of organic medicinal products. I choose to designate this consideration as the pattern of pharmacogenesis within the functional reorientation of the field of pharmacognosy. By emphasizing this aspect of crude drugs and their chemical composition and biological usefulness of natural substances can be more effectively implemented. These important relationships cannot be elucidated until we adopt a presentation in pharmacognosy that decidedly differs from the present morphological and descriptive consideration of crude drugs. My hope is that the short paper submitted will serve as a contribution to the present efforts to this end.

Arnold C. Neva,
University of Washington

February 12, 1949

Notes and News

University of Arizona.—On January 12, Dr. Edward C. Elliott, who with Mrs. Elliott is absorbing the Arizona sunshine during a well earned vacation, spoke before the assembled students on the subject, "The Moral Obligations of the Pharmacist."

University of Buffalo.—At a recent meeting of the student branch, Mr. George Bender, Editor of **Modern Pharmacy**, discussed the problem of professional relations between pharmacist and physician. Dr. LeRoy Keagle gave a brief review of the work of the Unitarian Service Committee's Medical Mission in Germany last summer, and Mr. Mearl D. Pritchard spoke about the work of the Joint Conference Committee on Federal Food, Drug, and Cosmetic Law Problems. The series of lectures by professional men in various fields constitutes the weekly program of the senior class seminar.—The fall enrollment reached a total of 331, including five graduate students.—On December 5, Dean A. B. Lemon presented to the New York State Board of Pharmacy, the results of a new type of licensing examination for the use of the Board. The examination, which was given for the first time last June, was developed by Dean Lemon on a commission from the State Education Department and the State Board of Pharmacy.—Dr. Chas. M. Dake, Jr., '24, has announced a gift of $1,200 to be increased by additional donations for the purpose of equipping a research laboratory for graduate work in pharmacy.

University of California.—A number of graduate teaching assistantships and three hospital pharmacy internships are open to qualified graduate students in pharmaceutical chemistry. These positions make it possible to pursue graduate work most advantageously. For details, write Dean F. C. Daniels, College of Pharmacy, The Medical Center, San Francisco 22.

University of Colorado.—The new pharmacy and chemistry building is under construction. The entire second floor of the $400,000 structure will be occupied by the College of Pharmacy, and the half-story above this floor will house chemical microscopy and sanitary and pharmaceutical chemistry.—A grant of $28,530 has been awarded the University by the Atomic Energy Commission for research on a cooperative project and study of nucleic acid derivatives. Dean Charles F. Poe and Dr. Norman Witt will direct the study on the crystal and optical properties of the new synthetic derivatives.—Mr. John P. Street, formerly with the Cutter Laboratories at Berkely, has been appointed to the staff as instructor in pharmacognosy.—Eleven students

were recently initiated into Rho Chi.—Dr. Lloyd E. Blauch, Associate Chief of Education for the Health Professions, Federal Security Agency, Office of Education at Washington, visited the University recently and discussed various educational problems with the pharmacy staff.

Columbia University.—The Bigelow Fellowship for graduate study will be available September 18, 1950. It is open to students holding the B.S. in Pharmacy. A stipulated amount of teaching service is required. The value of the Fellowship is approximately $700. Additional teaching compensation will yield a total of $1,000 to the incumbent. Tuition fees only are remitted. The appointment may be renewed annually, but the holding is limited to three years. For application, address the Registrar, Columbia University College of Pharmacy, New York 23, prior to April 1, 1950.

University of Connecticut.—A modern laboratory designed and equipped for reseach was completed during the summer, and the first graduate program was launched with the beginning of the current year. Three students are registered as candidates for the Master's degree.—Mr. John Zugich, chief pharmacist of the Grace-New Haven Hospital, spoke recently to the student branch on various aspects of hospital pharmacy.—Dr. Donald M. Sqauen and eleven members of Phi Delta Chi attended a New England fellowship meeting on December 8 in Boston.—Eli Lilly & Company have established a research fellowship of $1,800 for an investigation relating to the production of Ergot. The grant is effective September 1, and the study will be directed by Dr. Arthur E. Schwarting.

University of Florida.—Dean P. A. Foote was guest speaker at the Pittsburgh Branch meeting on December 6. His subject was "Interprofessional Relations."—The Duval County Pharmacy Auxiliary has established a $200 emergency loan fund for pharmacy students.

Fordham University.—Dr. Manganelli of the Abbott Laboratories and Dr. C. Paul Silirie of Merck and Company were recent speakers before the student body.—On November 30, Attorney Matthew Salonger, '27, spoke before the student branch on the subject, "The Perils of Going Into Business."—Sister Rose of Lima, M.M., '24, recently addressed the Sodality on her experiences as a Maryknoll missionary in Korea.—Dean James H. Kidder is recovering from an emergency appendectomy on December 1.—Recorder Mrs. Marion J. Martin was recently honored for 30 years of faithful service at a ceremony conducted by the Very Reverend Laurence J. McGinley, S.J., President of the university.

University of Georgia.—The dispensing laboratory has been equipped with telephones, and two display windows, one for new drug products and the other for a professional window display, have been built.—The Atlanta Drug and Chemical Club has announced two awards of $25 each for excellence in chemistry and in pharmacy, and Rho Chi has announced an award to be given to the outstanding first-year student.

Howard College, Birmingham.—John Wintter, Sarrah Norred, and Jack T. Bryan, recent graduates, are registered at the University of Florida for graduate work in pharmacy.—Elton Kytle, instructor in pharmacy, has resigned to take graduate work in pharmacology at the University of Alabama School of Medicnie.—Two papers on incompatibilities by the faculty and students have been selected from American drug journals to be reprinted in **El Farmaceutico** and **Pharmacy International.**—Mr. Roy L. Mundy, M.S., of the Medical College of the University of Alabama, has joined the faculty as instructor in pharmacology.—The student branch will observe social hygiene day with a program, the chief speaker being Mr. John K. Williams, social hygiene and health educator for the City of Birmingham.—The Alpha Gamma chapter of the Lambda Kappa Sigma Sorority has been installed with 16 charter members.—Plans for a pharmacy-biology building have been completed.

University of Illinois.—Ten research fellowships are available in medicine, dentistry, and pharmacy. For formal application blanks, apply to the Graduate College, 808 South Wood Street, Chicago 12.—Sharp & Dohme has awarded a grant of $1,500 to make a research investigation of the method of controlling drugs in hospitals.—New additions to the faculty are Dr. Dwight L. Deardorff in pharmacy, formerly Senior Fellow Mellon Institute; Dr. Charles A. Reed in zoology, formerly assistant professor of zoology, University of Arizona; and Miss Rose Grundman, M.S., in mathematics, formerly instructor at the University of Arizona.—Dr. Frank T. Maher has been appointed assistant dean.—A 4-quarter hour course in general economics has been instituted in the Senior Retail Major program to be followed by a 4-quarter hour course in principles of marketing.—Space changes have been authorized in the pharmacognosy laboratory to give research facilities for graduate students.—Mr. Floyd Swink, an expert in plant taxonomy and ecology, has been added to the staff in order to develop these phases of pharmacognosy in connection with the Drug Plant Experiment Station at the Morton Arboretum.—Construction of the greenhouse and service units of the Drug Plant Experiment Station, located near Lisle, immediately east of the Morton Arboretum, has been approved by the University Board of Trustees. A grant of $65,000 for the construction

of the buildings which will be used jointly by the colleges of pharmacy and agriculture has been made.

The State University of Iowa.—Recent changes in the curriculum include the expansion of the fourth year course in pharmaceutical chemistry from 2 to 3 hours and the introduction in the fourth year of a two-semester hour course in administrative pharmacy, which deals with federal, state, and community laws and regulations which affect pharmacy and the legal, moral, and ethical relations with the public, patrons, and other professional groups.—Dr. Moreshwar V. Nadkarni of India, who received his degree at the June commencement, has been awarded a one-year post-doctorate fellowship at the National Institute of Health in Bethesda, Maryland. At present, he is working in the cancer division of the Institute, specifically concerned with the chromatographic separation of the active constituents of podophyllum.—A total of 21 fellowships, scholarships, prizes and awards were made to students at the close of the last academic school year, effective for the current school year.—A collection of 275 books has been presented to the library by Fred W. Boerner, the son of Prof. Emil L. Boerner who was the first dean of the college of pharmacy having served in that capacity from 1885 to 1903.

University of Kansas City.—Registration for the fall semester was the largest in history.—Mr. James T. Reid has been appointed lecturer in pharmaceutical jurisprudence.—Dr. Louis Scarpellino contributed $50 to the purchase of equipment for the school.—The local retail druggists have offered a prize of $25 to the student making the best suggestions for closer cooperation between the students and the pharmacists of Kansas City.—Dr. Leslie D. Eisenbrandt presented a paper on "The Role of the Gastrointestinal Tract in the Excretion of Methadone Labeled with Carbon 14" before the Society of Pharmacology and Experimental Therapeutics at the recent meeting at Indianapolis.—The Sixth Annual Seminar held on the university campus was attended by 350 people interested in the drug industry.

Masachusetts College of Pharmacy.—George DiCicco, formerly with the control department of the Bristol Laboratories, Inc., has been appointed as instructor in pharmacy.—W. E. Hassan, Jr., has been advanced from assistant to instructor in biology and pharmacognosy.—C. H. Costello has resigned as special assistant in chemistry to become director of the Columbus Pharmacal Company.—Mrs. Barbara Cowles, who is chairman of the Serials Round Table Committee on Indexing and Abstracting of the American Library Association, has been appointed assistant librarian.—Dr. Heber W. Youngken, Sr., addressed the Plant Institute sponsored by the department of agronomy., Ohio State University, at the November meeting, on the subject "Drug Plant

Production and Its Problems."—In addition to the seminars in special fields, the graduate school now offers a **general seminar** which is compulsory for all graduate students.—A new bacteriological laboratory has been completed with the instillation of the most modern equipment.

University of Minnesota.—Eleven seniors were initiated into Phi Lambda Upsilon, honorary chemical society on December 5.—Dean Chas. Rogers was the principal speaker and Dr. C. V. Netz presided as toastmaster at the testimonial dinner given to Dr. Frank W. Moudry by the druggists of Minnesota on November 17.—A new 1,200,000 class room building is under construction across the street from Wulling Hall. This represents a part of the nearly $25,000,000 construction program for new buildings since World War II.

University of Mississippi.—Dr. John L. Voight has joined the staff of the pharmacy department. He was formerly with the University of Southern California.—Clyde Hutchins, B.S., has been appointed as an instructor in pharmacy.—A new laboratory for research in pharmaceutical chemistry has been installed.—The student branch has a total membership of 276.

Montana State University.—The construction of a 30 x 40 ft. brick animal house is now under way as an addition to the present pharmacy building. It will include a room for surgery, one for bioassay, three animal rooms, an incinerator and a drug milling room.—Recent additions have been made to the manufacturing laboratory among which is a granulating and drying oven equipped with infra-red heaters and blowers. The equipment was designed by and constructed under the direction of the pharmacy staff.—Kappa Psi has presented the library with $150 for the purchase of books.

University of New Mexico.—Cases have been built over the balances in the pharmaceutical chemistry laboratory to give them greater isolation and protection.—A new fully equipped desk has been placed in the pharmacy manufacturing laboratory for the use of the faculty.—A large steel herbarium case is being installed in the pharmacognosy laboratory for the preservation of crude drug specimens.—Mr. Robert McKinley has been placed in charge of the storeroom.—Application for a student branch of the A.Ph.A. has been made by a committee of the Apothecary Club.—Dr. Raymond N. Castle of the department of pharmaceutical chemistry has received a grant of $1,700 from the Upjohn Company for a study on the synthesis of organic medicinal chemicals.—Dean R. A. Bowers was re-elected secretary-treasurer of Rho Chi at the Jacksonville meeting.—Dr. George M. Hocking attended a meeting of the Ex-

ecutive Committee of Review of the National Formulary at Washington on October 8 and 9.—A total of 140 students registered at the beginning of the fall semester.

University of North Carolina.—Extensive improvements have doubled the laboratory space for graduate work in pharmacognosy.—Sharp & Dohme, through the North Carolina Pharmaceutical Research Foundation, has made a grant of $700 for research aid to Dr. Walter Hartung, and an annual stipend of $1,500 for a research fellowship, the work to be directed by Dr. Hartung.—Dr. E. A. Brecht has been elected chairman of the American Pharmaceutical Association Committee on the U.S.P.—Congressman Carl Durham spoke recently before the Seminar program on the work of the Atomic Energy Commission.—In competition for the best student program, the Pharmacy Senate presented a senatorial investigation of Fair Trade.

North Dakota Agricultural College—Dr. Richard K. Thoms, formerly of the research laboratories of E. R. Squibbs & Sons, has joined the staff as professor of pharmacology; and Mr. Melvin Rubin, M.S., 1949, of Ohio State University, is a new instructor in pharmacy.—Eight pharmacy seniors were recently initiated into Phi Kappa Phi, national honorary scholastic fraternity.

Ohio State University.—Dr. David N. Kramer, who holds the A.B. degree from Johns Hopkins and the Ph.D. from the University of Maryland, has been appointed as instructor in pharmacology.—Drs. Colby, Nelson, and Guth attended the Cincinnati meeting of District No. 4. The latter two presented papers.—The pharmacy alumni advisory board inspected the school and held conferences with the faculty in October. The chief subjects discussed were the graduate program and the pharmacy R.O.T.C. unit.—Twenty graduate students are enrolled for the winter quarter.—Dr. Heber W. Youngken was the guest speaker before the Plant Science Institute in November.

Univrsity of Oklahoma.—Dean Henry M. Burlage of the University of Texas spoke before the Oklahoma University Pharmaceutical Association in December on the subject "Organization in Pharmacy," and before the Rho Chi society on "Friends in Pharmacy."—Rho Chi has recently initiated eleven new undergraduate members and one faculty member, Dr. John Bruce, assistant professor of chemistry.—Dr. Ralph Beinfang has been elected to an honorary membership in Associacao de Farmaceuticos de Estado do Rio de Janeiro of Brazil.

Oregon State College.—290 students enrolled for the fall term, which is an 8% increase over the previous year.—A five year program

has been submitted to the curriculum committee for consideration and action.—Prof. Leo Schiuchetti completed a first aid instructors' course and a course on community safety organization at the school held at Pacific Grove, California, in October.

Philadelphia College of Pharmacy & Science.—On December 15, a total of fifteen scholarships and one fellowship was announced at a special assembly.—Dr. Julian Ambrus and his wife, Dr. Clara Ambrus, will join the staff on September 1. Both doctors are graduates of the Universities of Budapest and Zurich, holding medical degrees from the latter institution. Both have held teaching positions at their alma maters, and, during the past year, they have continued these studies at the Pasteur Institute in Paris. They will initiate research in the new laboratory of biochemistry and pharmacology under the direction of Dr. Joseph W. E. Harrisson.

University of Pittsburgh.—Dr. Robert W. Sager, who recently received the doctorate from the University of Washington, has joined the staff as assistant professor of pharmacy.

Rutgers University.—Several teaching assistantships are available for the academic year 1950-51. These positions require approximately one-third of the time, and the stipend is $1,200 on a twelve months basis (one month's vacation), plus the remission of fees. For information, address the Dean, 1 Lincoln Avenue, Newark 4, New Jersey.

Southern College of Pharmacy, Inc.—287 students enrolled for the fall quarter. Dean R. C. Hood and Prof. H. C. Ward have both recovered from recent illnesses.

University of Southern California.—Dean Alvah C. Hall addressed the meeting of District No. 8 at Reno, Nevada, October 31, on "Predictive Testing for Pharmacy Students."—Margaret Airston is this year's secretary for the Southern California Chapter of the Society of Sigma Xi. She is also vice-president of the Faculty Women's Club.

University of Tennessee.—The bachelor's degree was conferred upon 63 students on December 19, 1949.—Dean Glenn L. Jenkins of Purdue was the commencement speaker. His subject was "Professional Freedom Has Its Price."—Twenty members of the senior class were initiated into Rho Chi in October.—Mr. Howard Hassler, '49, was appointed instructor in pharmacy effective January 1, 1950. He will also serve as pharmacist for the West Tennessee State Hospital for the tubercular.—Dr. Albert Musick spent two weeks in December visiting points of interest in Guatemala and the school of pharmacy in Havana, Cuba.

University of Texas.—New members on the staff effective in September, 1949, are Dr. Robert F. Doerge, in pharmaceutical chemistry; Dr. Melvin A. Chambers, in pharmacognosy; Dr. Wm. R. Lloyd, in pharmacy; and Mr. Robert G. Brown, in pharmacology.—Mr. Joseph Nash is on leave for the current year engaged in graduate work in pharmacology in the medical branch of the University of Galveston.—New courses are being offered this year at the undergraduate level in animal health pharmacy, raw materials in industrial pharmacy, household remedies, biochemistry, and the chemistry of natural products.—A limited number of new graduate courses will be offered the second semester.—A 5-year program is being offered conjointly by the department of journalism and the college of pharmacy leading to the B.J. and the B.S. in Pharmacy degrees.—Profs. Boenigh and Mittelstaedt have undertaken a prescription survey in the state of Texas to determine the trends in prescription writing, and to compare the results with those obtained by The Pharmaceutical Survey.—The pharmacy staff is beginning a panel discussion of the six-year program, and the effects it will probably have upon the various fields of pharmaceutical endeavor.—Plans and specifications for a $1,250,000 pharmacy building are now in the hands of and being considered by the board of regents.

University of Toledo.—The pharmacy program has been changed to one year of pre-pharmacy with 32 hours of designated work with a grade "C" average in the College of Arts and Sciences. The last three years of the course require registration in the College of Pharmacy.

Medical College of Virginia.—Dr. Warren E. Weaver has been appointed associate professor of pharmaceutical chemistry, effective April 1, 1950. He takes the place of Dr. Karl Kaufman, now of Butler University. Dr. Weaver holds the doctorate from the University of Maryland and recently has been in charge of fungicide development at the Naval Research Laboratory.—Dr. Neuroth was in charge of the preparations for the national convention of Kappa Psi held in Richmond during the holidays. Speakers on the program included Dr. Powers and Fischelis and Mr. George Frates.

State College of Washington.—A number of graduate fellowships and assistantships are available for graduate students . For details, address the dean of the graduate school, Pullman.

University of Washington.—The $9,000,000 new Health Sciences Building housing the university's new schools of medicine and dentistry, and the school of nursing that was established in 1917, was dedicated on October 9. An addition for the college of pharmacy, the fourth unit of the Health Sciences Division, will be built later. A $10,000,000

teaching and research hospital also is in the plans for the immediate future. The dedicatory address was given by Dr. Donald G. Anderson, secretary of the Council on Medical Education and Hospitals of the American Medical Association, and Governor Arthur B. Langlie laid the corner stone. It is needless to say the building and the equipment is modern and complete in every respect.—Dr. E. M. Plein is secretary of the newly organized Washington State Branch of the American Association of Hospital Pharmacists.—Dr. Louis Fischer was the Province Delegate for Kappa Psi at the national conclave at Richmond, Virginia, in December 1949.—Dean F. J. Goodrich and Dr. H. A. Langenhan attended the U.S.P. Revision Committee meeting in Philadelphia in November.—Two new courses, one in Emulsions and Colloids and the other on Pharmaceutical Solvents and Extraction Processes have been added to the graduate offerings.—The first postgraduate refresher course has been scheduled for March 6 and 7, 1950. The program will include lectures on antibiotics, antihistaminics, new drugs, ammoniated dentifrices, pharmacology of cardiac drugs, buffered and isotomic solutions, and a panel recapitulation of the entire program.—Drs. Walter McCarthy and Robert Miller are two new assistant professors on the staff.

University of Wisconsin.—Dr. George Urdang has been awarded the Schelenz Plaque as an international recognition of his work in the history of pharmacy. The **"Gesellschaft fuer Gasehichte der Pharmazie,"** donor of the award, has also named Dr. Urdang an honorary member. Alex Berman of New York, VA pharmacist on leave, has become the second graduate student in history of pharmacy under Dr. Urdang. He is working toward the Master's degree.—A special course is being offered for the first time by Dr. Higuchi on the processes of adsorption and extraction.—A number of grants for research have been made to members of the staff by the Alumni Research Foundation and the Research Products Corporation for the continuation of studies now in progress.—Dr. Ray E. Green, who has been conducting research on a Rockefeller fellowship at the medical school, has joined the pharmacy staff and will teach the course in pharmacology.—The fall enrollment totals 395 undergraduates and 30 graduate students.—As a result of a recent action of the regents of the university, the work in pharmacy, which at present is organized as a department in the College of Letters and Science, will be set up as a separate school on July 1, 1950.—Specialization in the various fields of pharmacy is open at the university for those seeking the finest conditions for graduate study. For information, address Dr. Arthur H. Uhl, University of Wisconsin at Madison.

University of Wyoming.—Prof. Jack N. Bone presented a paper on "Important Medical Products Obtained by the Fractionation of Blood"

before the annual convention of the Rocky Mountain Section of the American Student Health Association held in Laramie in October.—Dean David W. O'Day was recently chosen chairman-elect of the Wyoming Section of the American Chemical Society.—Dr. T. O. King, professor of pharmacology, and Dr. R. H. Denniston, professor of physiology, and Dr. William Solheim, head of the department of botany, attended the meetings of the American Association for the Advancement of Science in December.

NEW IN THE FAMILY

Patricia Ruth Lehnhardt.—Born November 10, 1949, daughter of Mr. and Mrs. John E. Lehnhardt, University of Pittsburgh.

Eldon Patterson West.—Born November 24, 1949, son of Mr. and Mrs. Henry E. West, University of Pittsburgh.

Michele Ann Janosko.—Born October 15, 1949, daughter of Mr. and Mrs. M. L. Janosko, University of Pittsburgh.

Jack Floridia.—Born October 19, 1949, son of Mr. and Mrs. Conrad J. Floridia, Fordham University.

Albert Sica.—Born November 9, 1949, son of Dr. and Mrs. Albert J. Sica, Fordham University.

Luis Augusto Moreno.—Born January 31, 1949, son of Mr. and Mrs. J. R. Moreno, University of Texas.

Everett Eugene Jones.—Born September 19, 1949, son of Mr. and Mrs. T. Everett Jones, University of Texas.

Daniel Robert Doerge.—Born October 22, 1949, son of Dr. and Mrs. Robert F. Doerge, University of Texas.

Virginia Ann Hall.—Born October 22, 1949, daughter of Mr. and Mrs. Kennis Hall, University of Texas.

Sandra Kay Brown.—Born October 27, 1949, daughter of Prof. and Mrs. Robert G. Brown, University of Texas.

Mary Jane Bowers.—Born September 14, 1948, daughter of Dean and Mrs. R. A. Bowers, University of New Mexico.

George Leonard Castle.—Born September 7, 1949, son of Prof. and Mrs. Raymond N. Castle.

Willis Ralph Brewer, Jr.—Born January 19, 1950, son of Dr. and Mrs. Willis R. Brewer, University of Arizona.

Miscellaneous Items of Interest

A MEMORIAL

CLAIR ALBERT DYE

On October 10, 1949, Clair Albert Oye, Dean Emeritus of the College of Pharmacy at The Ohio State University, passed from among us after a protracted illness of several years, but his memory will remain with us always. No man was ever more beloved by his students; he was not only their teacher, but also their friend who gave them kindly and fatherly advice upon all matters imparted to him in confidence, as well as upon their school work. And now with bowed heads and sad hearts, they join his wife, Flora Elder Dye and his sister Mrs. W. A. Richey, in their sorrow. He was buried at McConnelsville, Ohio, his early boyhood home.

Dean Dye was a graduate of the Class of 1886 of the McConnelsville High School and of The Ohio University in 1891. He later continued his study of Pharmacognosy at the University of Berne, Switzerland, from which he received his Doctorate Degree with honors in 1901. Upon his return to the United States, he became a member of the faculty of the College of Pharmacy at Ohio State and in 1921 became Dean. He was connected with Ohio State for a period of forty-nine years. He had hoped to round out fifty years of service, but was forced to retire in accordance to the regulations of the University at the age of seventy.

He was a member of the American Pharmaceutical Association and the Ohio State Pharmaceutical Association and a past president of the American Association of College of Pharmacy. He was a member of Sigma Xi and Phi Delta Chi fraternities. He served on many committees of both the national and the state organizations.

CLARENCE M. BROWN

MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF THE AMERICAN FOUNDATION FOR PHARMACEUTICAL EDUCATION

330 West 42nd St., New York 18, N. Y.
THURSDAY, JAN. 26, 1950

The meeting was called to order by President Charles S. Beardsley at 12 Noon. The Secretary recorded Directors present as follows:
Charles S. Beardsley H. C. Newton Carl S. Willingham

Edgar S. Bellis S. B. Penick
Joseph B. Burt R. L. Swain
E. L. Newcomb, Secy.

The Secretary announced that a quorum was present.

President Beardsley requested the Directors to give consideration to the items on the docket as follows:

1. The Secretary reported that the Board of Grants had utilized $96,484.74 for domestic Fellows for stipends, out of $100,000 provided by the Board of Directors at a meeting in April, 1949, and that an additional sum of approximately $20,000 would be required by the Board of Grants to carry current fellowship students through to the end of the Foundation year, April 3, 1950. After brief discussion, and motion duly made, it was unanimously voted that the Directors approved further allocation of $20,000 to be used for graduate fellowship stipends and expense allowance.

2. Secretary reported that the Board of Grants had continued to support existing Foundation Fellows who were foreign students, as authorized by the Directors at their meeting on April 14, and that a total of $18,543.22 had been required o carry these existing foreign Fellows along. The Secretary also advised that the Board of Directors had only allocated $15,000 for this purpose at the April meeting. The Secretary ascertained than an additional $7,708 would be required to carry these students through to the April 3, 1950 meeting of the Directors. Following discussion, and motion duly made and seconded, it was unanimously voted that an additional $10,000 be provided to the Board of Grants to carry along these Foundation Fellows who are foreign students.

3. The Board of Directors next took up a request for funds from the AACP to be used in defraying the expense of a pharmacy administration seminar to be held at Ohio State University, Columbus, Ohio, June 13 to June 30, 1950. Director Burt presented a comprehensive report on the proposed seminar. The report called for a total of $8,156. A copy of this report is attached for those Directors who did not attend the meeting. After thorough discussion and in accordance with a suggestion by Director Burt, and motion duly made and seconded, it was unanimously voted that the sum of $6,000 be provided to the AACP for use in connection with the conduct of the pharmacy administration seminar to be held at Ohio State University.

4. The Secretary presented a report from Secretary Zopf of the AACP covering the receipts and expenditures in connection with the pharmacy seminar held at the University of Wisconsin during July, 1949.

The report showed that of the $6,000 provided by the Foundation, $1,298.26 remained at the close of the seminar and that this was being used to cover the cost of printing the papers and addresses delivered at the seminar in the American Journal of Pharmaceutical Education or supplement thereof. The report was received as satisfactory. (Financial report from Secretary Zopf is attached).

5. The Board next took up the request for financial support for the Journal of the AACP for the year 1950. This was discussed at considerable length, emphasis being placed upon the present mailing of the Journal to patrons of the Foundation; also to the availability of the pages of the Journal to the Foundation and publishing in each issue, reports of Foundation activities. Finally, on motion duly made and seconded, it was unanimously voted that a sum not to exceed up to $5,000 should be provided to assist in defraying the costs of publishing the Journal of the AACP for the year 1950.

6. The Secretary next made a report on utilization of Foundation funds for the awarding of undergraduate scholarships—1943 to date. This report showed that a total of 350 undergraduate scholarships had been awarded to male students of which 76 were renewals. A total of 495 undergraduate scholarships had been awarded to females of which 149 were renewals. The total number of all undergraduate scholarships awarded by accredited colleges from funds supplied by the Foundation up to November 15, 1949, was 845.

The Secretary also reported that 29 accredited colleges of pharmacy accepted the Foundation offer up to $400 each for undergraduate scholarships to be matched by the school in an equal amount, and to be used for Juniors and Seniors in the upper quarter of their class. The discussion brought out the fact that the schools were almost equally divided on the desirability of continuing Foundation funds for undergraduate scholarships. The report was received as a matter of information.

7. The Directors next entered into a lengthy discussion on a proposal submitted by Dr. E. C. Elliott that the Foundation provide funds to carry forward achievement tests covering some 2000 students who took predictive tests under The Pharmaceutical Survey program. It was the final decision of the Directors in attendance that funds should be provided to complete this study on the testing of students, both predictive and achievement.

It was pointed out that some $15,000 had been expended by the Foundation in the conduct of the predictive tests and that unless these achievement tests were applied to the same students, that no satisfactory analysis could be made as to whether or not the tests

were satisfactory. It was the final unanimous decision of the Directors in attendance that funds in the amount of $7,000 as requested, should be provided to provide for the conduct, compilation and publication of these achievement tests for pharmacy students who were given the predictive tests in 1946.

8. The Secretary called upon Director Swain to discuss the work of the American Council on Pharmaceutical Education and its need for funds from the Foundation to carry on its work of implementation of the Pharmaceutical Survey. Dr. Swain reported fully upon the work which the Council had already done in reinspecting schools of pharmacy and the plans that it intended to carry out during 1950 which provided for quite fully completing all of the reinspecting work. He indicated that work thus far done was resulting in very substantial improvement in the facilities and functioning of the colleges which had been visited. He recommended strongly that the Foundation again appropriate a sum of $20,000, to enable the Council to carry forward its important work of reinspecting accredited colleges of pharmacy.

This was discussed in considerable length and on motion duly made and seconded, unanimously approved.

9. Dr. Swain as Chairman of the Special Committee appointed by President Beardsley, on enlarging, expanding and extending Foundation activities presented a preliminary report on this subject. He advised that he had conferred with Dr. Little, as one member of his committee: also with Counsel Hoge, and that his committee was preparing a report which would include a proposed amendment to the By-Laws of the Foundation providing for enlarging the Board of Directors to a number not to exceed twenty-five, and that this would afford an opportunity for bringing into the Foundation work, a larger number of outstanding men in the field of pharmacy, some of whom already had indicated willingness to cooperate.

A plan of enlarging the Board of Directors was discussed at length and the consensus of opinion was that such a change was most desirable. Complete report on this sub-committee will be submitted at the time of the annual meeting.

10. Secretary presented information concerning an earlier proposal that the A.F.P.E. should be a member of the American Council on Education. He advised that Institutional Membership in the American Council on Education, carrying the right to vote would involve a cost of $50 per year and that the Vice-President of the Council, Dr A. J. Brumbaugh, had written that they would be delighted to have application from the Foundation for such a membership. After brief discussion,

it was unanimously voted that the Foundation apply to the American Council on Education for Institutional Membership.

11. The Secretary presented a final financial report from Dr. Elliott on the Pharmaceutical Survey which was received as a matter of infomation. Copy is attached to these minutes.

12. The Secretary presented a communication from Gerald Friedman, Chairman of News Letter Committee, Inter-pharmaceutical Press Association, requesting the Foundation to consider financial aid to this group. After brief discussion, we decided that no action should be taken at this time on this subject.

13. Treasurer Penick requested that the Board authorize the Treasurer to make arrangements for the proper auditing of the Foundation books for the year ending April 3, 1950. On motion made and duly seconded, this was approved.

The meeting was adjourned at 3:30 p. m.

E. L. NEWCOMB
Secretary and Managing Director

The following is a brief abstract of a report just received from Secretary P. H. Costello of The American Council of Pharmaceutical Education:

"Forty Colleges of Pharmacy were visited and examined by Dr. Edward C. Elliott, accompanied by another member of the Council during the period from December 5, 1948 to December 21, 1949. A member of the Board of Pharmacy in the state in which these colleges were located participated in the examination. A sizable number of the recommendations made to the colleges have already been complied with. Appropriations and support for the colleges has been increased perceptibly. Teaching staffs have improved in quality and quantity. Better facilities have been provided for classroom and laboratory instruction.

Thirty-three schools of pharmacy remain to be examined and some that have been examined must be revisited. Dr. Edward C. Elliott has consented to serve as Acting Director of Educational Relations on a tentative basis until December 31, 1950 and plans are being made for the examination of as many colleges as possible beginning the latter part of March and continuing until colleges recess in June, beginning again October 1 and continuing through December. The Council has engaged a Director of Education Relations who will obtain leave of absence for one year from the institution he serves as a staff member and serve the Council for that period beginning September 1, 1950."

ERNEST LITTLE, REMINGTON MEDALIST
(A Citation)

In presenting the 1949 Remington Medal, Dr. Curt P. Wimmer spoke, as follows:

"No doubt, you have been sitting through these speeches wondering whether the ceremony were not an iridescent dream from which you would presently awaken in the cold-gray light of an early dawn.

"Possibly, you were astounded at the many fine things which were said about Ernest Little; things which you never suspected of being known, much less remembered and appreciated. And I have no doubt that when you realized that you were the Ernest Little they were talking about there was deep down in you a certain feeling of fearsome uneasiness as to what next they might bring out about you.

"Well, fear not. The speeches are over; the oratory has been silenced—but 800 eyes are fixed upon you and 800 ears are strained to hear what is to follow.

"I have been commissioned to present to you—and I consider it a privilege to do so—the visible token, the symbol of a great honor that has been conferred upon you.

"You have been a speaker at several occasions when the Remington Medal was awarded to others. It may well be that way deep down in your heart there was a silent little wish that some day you might be found worthy to be in the recipient's place. Now, it has happened and this is **Your Day, this is Your Hour** and these are **Your many friends** and admirers who have come far and near to do you honor, for your excellent work in the realm of pharmacy.

"The Remington Award is the highest that American pharmacy can bestow on any man. Its possession makes you a member of a group of marked men; men marked for pre-eminence, known as the Remingtonians.

"Professor Remington himself is here in spirit with his twenty-six disciples. They extend their hands to you in welcome. They wish—and all of us join in that wish—that this golden symbol may be to you a source of pleasurable satisfaction and, in its proud possession, a reminder of the love and admiration that we hold for you.

"Now, speaking for the New York Branch of the American Pharmaceutical Association, I have the honor of presenting this medal to you with sincere congratulations."

A PROPOSAL TO CHANGE THE BY-LAWS

To Member Colleges of the American

Association of Colleges of Pharmacy:

We are submitting herewith the report of the Committee on Constitution and By-Laws, (J. Allan Reese, Lloyd M. Parks, and Hugo H. Schaefer, Chairman), which embodies three proposals for amendments to the qualifications for admission to and membership in the American Association of Colleges of Pharmacy.

Report of Committee on Constitution and By-Laws

A number of proposals to change the By-Laws of the American Association of Colleges of Pharmacy were presented at the 1949 Jacksonville meeting of the Association. Since these involve changes in qualifications for membership in the Association they must be presented in writing at one meeting, sent out by mail at least four months prior to a subsequent meeting, at which time a final vote may be taken. A two-thirds majority of the member colleges voting is necessary for adoption.

The proposed changes embodied in this communication have all been presented at the Jacksonville meeting and will be **subject to a final vote at the 1950 Atlantic City meeting** of the Association. All the proposed changes in this communication apply to Article I, Section 6, entitled "Curriculum and Degrees" of the present By-Laws of the Association and for your guidance and proper understanding a copy of the entire section is enclosed herewith.

Proposal A. From Dr. B. V. Christensen's report of the Committee on Constitution and By-Laws.

This proposed change is intended to permit colleges that **desire to do so** to offer a six year curriculum consisting of not less than four years of professional study and to grant a Doctor of Phormacy degree on completion of such a curriculum. The proposals if adopted would be **permissive** in character, but **not** mandatory. The changes affect Article I, Section 6, Paragraphs a and c, which would read as follows:

6. Curriculum and Degrees

a. The minimum curriculum shall be of not less than four college years, regular annual sessions, of not less than thirty-two weeks each. The instruction shall be scheduled over not less than five days a week. A curriculum of six college years, regular annual sessions, which includes not less than four years

of pharmaceutical professional education and training may be offered.

c. The degree of Bachelor of Science (B.S.) or Bachelor of Science in Pharmacy (B.S. in Phar.), and only these degrees may be granted on completion of the four year curriculum. The degree of Doctor of Pharmacy (Phar.D.) may be granted on the completion of the six year curriculum.

Proposal B. From Dean Hayman's presidential report and approved by the Association in the form of a resolution.

This change would prohibit any college from offering both a four and a six year course except during the overlapping or transition period. It would be in the form of an added paragraph (d.) to Article I, Section 6 of the By-Laws. Unless Proposal C is adopted it would apply only to those Colleges that voluntarily adopt the six year curriculum. The proposed change reads as follows:

d. A college which adopts a program calling for a specified term of non-professional collegiate instruction as a minimum requirement for admission to a four year professional course shall not admit Freshmen students to a course based on lower admission requirements beginning with the school year in which the higher requirements become effective. Students applying for advanced standing in such a college must meet the admission standards originally required of the students in the class to which admission is being sought, in addition to meeting all other requirements for advanced standing.

Proposal C. From the Committee on Curriculum. This proposed change would make mandatory the adoption of a program of six collegiate years consisting of two years of general and four years of professional study beginning with the fall enrollment of 1956. It would add a new paragraph to Article I, Section 6 of the By-Laws and read as follows:

c. After the fall enrollment of 1955, no students may be accepted by member colleges for enrollment in a four year curriculum leading to the degree of Bachelor of Science (B.S.) or Bachelor of Science in Pharmacy (B.S. in Phar.) and beginning with the fall enrollment of 1956, all member colleges shall require two years of collegiate instruction, comprising a minimum of 60 semester hours, or their equivalent of specified and elective subjects for admission to a professional curriculum in Pharmacy comprising four years of collegiate instruction of not less than 128 semester hours, or their equivalent.

Please study these proposed changes and compare with the present version of Section 6, a copy of which is appended. Be prepared to vote on the proposals at the 1950 Atlantic City Meeting.

Committee on Constitution and By-Laws
HUGO H. SCHAEFER, Chairman

You will note that the Committee report includes brief statements interpreting the proposed amendments and explaining the effects of their adoption. The circulation of the report at this time constitutes official notice in writing of proposals to amend Article I of the By-Laws and is submitted at least four months prior to the vote on their adoption, in accordance with Section 12 of Article I of the By-Laws of the American Association of Colleges of Pharmacy. It should be understood that a roll call vote of the member colleges will be held at the Atlantic City meeting of the Association on each of the three proposals outlined by the Committee. A two-thirds majority of all member colleges voting on any of the proposed changes is necessary for its adoption.

JOSEPH B. BURT, Chairman
Executive Committee

December 3, 1949

Article I, Section 6, Curriculum and Degrees as at present in the By-Laws of the Association.

6. Curriculum and Degrees

a. Instruction shall be given within a period of not less than four full college years of at least 32 weeks each, and shall be scheduled over a minimum of five days per week.

b. A college may, with the approval of the Association, be permitted to shorten this time provided additional work is done in a regularly organized summer session in an approved institution and provided further that all the required hours have been completed.

c. The degree of Bachelor of Science (B.S.) or Bachelor of Science in Pharmacy (B.S. in Phar.) and these degrees only, may be given for the completion of the four-year course.

THE ANNUAL MEETING OF THE AMERICAN INSTITUTE OF THE HISTORY OF PHARMACY

The meeting was held at the University of Wisconsin on April 4, 1949.

Dr. A. H. Uhl, in his presidential address cited several examples of the growing recognition of the Institute both at home and abroad.

He also called attention to the fact that the financial support of the Institute is still a major problem. Special needs include funds for clinical assistance and the publication of a highly specialized quarterly publication. A five-year budget plan is being prepared which, it is hoped, will be supported by all phases of professional pharmacy, including the pharmaceutical industry. Such a plan would make possible a long-time program which is needed for an uninterrupted growth.

Treasurer Dretzka's financial report covering the period from July 21, 1948, to March 31, 1949, showed receipts from membership dues, special contributions, and sale of books and brochures to be $1,659.60. The total disbursements during the same period, covering postage, printing, stationery, office equipment, and miscellaneous items amounted to $632.52. Cash balance March 31 was $3,182.02.

Dr. Urdang, in his report, covered the accomplishments of the year, many of which have been mentioned in this Journal and in the pharmaceutical press in general. Especially did he stress the significance of the First Pan-American Conference of Pharmacy held in Havana during the year, where he was a guest and served as Chairman of the Section on History of Pharmacy in the Americas. He referred to the spirit of cultural and professional cooperation represented by the Congress, and said, "Perhaps representatives of the United States are too much inclined to emphasize the externally obvious defects and differences of opinion in the Congress. Destiny and geography force the North and South Americas into a common community; and in view of this, difference of opinion should be neither unexpected nor overemphasized."

Two resolutions from the Historical Section which were approved by the Congress are of special interest: (1) Action directed to establish organized historical activities in pharmacy in the Americas with the Institute recognized as the hemisphere center of research, and (2) recommendation of a series of monographs on history of pharmacy in all the countries of the Americas, edited and published by the Institute, and authored by historians in the countries concerned. Dr. Urdang pointed out that scholarly work of this kind is by nature international, and that the Institute should try to serve the brotherhood and cultural ties of Pan-American pharmacy.

Dr. Torres-Dias of the University of Puerto Rico expressed from the floor his appreciation of the section of Dr. Urdang's report concerning Pan-American pharmacy, and referred to Latin American efforts toward more rapid and scientific progress and professional as well as political solidity.

Dr. Urdang's annual report as director of the Institute included the progress in teaching in the historical field of pharmacy at the

University of Wisconsin; the contributions made during the year to members of the Institute; publications and addresses, pictorial history and explanatory notes; book reviews and bibliographies; correspondence and assistance rendered; and a statement of future plans.

The following officers were elected for the current year: A. J. Horlick, honorary president; A. H. Uhl, president; Glenn Sonnedecker, secretary; Sylvester H. Dretzka, treasurer; George Urdang, director; and B. V.. Christensen, Rufus A. Lyman, E. L. Newcomb, 1st, 2nd, and 3rd vice-presidents respectively. Conrad F. Asenjo, J Goodrich, Roy Bird Cook, Ivor Griffith, Edward J. Ireland, Charles O. Lee, Oscar Rennebohm, C. H. Rogers, Wortley F. Rudd, and Hugo H .Schaefer were re-elected members of the council.—R.A.L.

NEW BOOKS

Antibiotics, by Robertson Pratt, Ph.D., Associate Professor of Pharmacognosy and Plant Physiology, University of California College of Pharmacy; Consultant on Antibiotic Research, and Jean Dufrenoy, D.Sci. (Paris), Research Associate in Antibiotics, University of California College of Pharmacy, 1949. 66 Illustrations. Price $5.00. J .B. Lippincott Co.

The authors have carried out their expressed purpose in an admirable manner which is "to present in a succinct, integrated plan the facts and principles of fundamental and permanent value relating to antibiotics." The object has been, first "—to give an understanding of the fact that, in developing chemical therapy by means of antibiotics, man has merely adapted to his own ends the capacity that certain micro-organisms possess to wage a war of extermination against other micro-organisms, and, second, to present a general survey of the principles involved in the industrial, commercial, pharmaceutical, and medical aspects of the field of antibiotics."

The authors have met the "genuine need for a treatment of the broad principles of antibiotics and antibiotic chemotherapy sufficiently comprehensive to satisfy those whose business is concerned with the health science but not so technical as to discourage the interested individual whose major activities lie in other fields." The gap between the brief popular accounts and the technical accounts intended for specialists has been abridged. All important critical review papers are listed, as are the principal scientific articles of historical interest.

The chapter headings are as follows: 1. The Concept of antibiosis; 2. Biologic Significance of Fields of Diffusion; 3. Industrial

Production and Control of Antibiotics; 4. The Concept of Antibiotic Spectra; 5. Pennicilin; 6. Streptomycin; 7. Chloromycetin and Aureomycin; 8. Polymyxin; 9. Tyrothricin; 10. Other Antibiotics; 11. Mechanisms of Antibotic Action; and 12. Retrospects and Prospects.

In those institutions who plan or have specialized courses dealing with the antibiotics, this reviewer recommends this well written book as a text. In those instances in which antibiosis is included in the materia medica or pharmacology courses, the briefness of the discussion in the majority of the texts indicate a need for supplementation of the material in this increasingly important field wih a book such as this which has achieved an integration of pertinent facts and principles in a coherent picture.—W. R. Byrum.

Marihuana in Latin America—The Threat it Constitutes, by P. O. Wolff, M.D., Ph.D., M.A., Member of Expert Committee on Habit Forming Drugs of the World Health Organization. Sponsored by Washington Institute of Medicine. The Linacre Press Inc., Washington 6, D. C., 1949. 56 pages, price $1.50.

The general public, and even members of the health professions, pharmacists and physicians, often think of the use by addicts of the extract of hemp (Cannabis sativa L.), now commonly called marihuana, only in connection with sporadic reports in the daily press on movie-stars indulging in the illegal smoking of the destructive, body and moral undermining drug. It hardly enters their mind that, to quote from Dr. Wolff's illuminating booklet, "the drug addicts of whom we speak are estimated, throughout the world, at some 200 millions" and that marihuana "is the only drug of its kind that can be consumed without previous chemical processing, whereby "its exceedingly low price brings it within reach of the very poorest". In these United States during 1948, more than 1300 stocks of the drug carried by peddlers and other dealers were confiscated.

Furthermore we welcomed that, instead of the many more or less fancy tales about marihuana, the true story has been presented by an expert who is well versed in the medical and pharmaceutical as well as in the social aspects of his topic and is in full possession of the statistical data. There is no phase of interest that has not been explored by him and explained in a very succinct way. An additional merit of this booklet is the excellent style in which it is written. In the foreword, authored by the U. S. Commissioner of Narcotics, Mr. Harry J. Anslinger, the highest U. S. authority in the field not only states that Dr. Wolff "has done his usual erudite, well documented job", but emphasizes the complete impartiality of the author and recommends the book "to readers desiring a comprehensive and accurate view of this wide-spread evil". This booklet is a **"must"** for everyone in pharmacy.—George Urdang.

Organic Chemistry, by G. Gryant Bachman, Professor of Chemistry, Purdue University. 1949. 432 pages. Illustration and structural formulas. McGraw-Hill Book Company, Incorporated (International Chemical Series). Price $4.25.

The basic principles of general organic chemistry are unfolded in an easy and practical manner which is of benefit to students who are not majoring in chemistry but who need the generalizations and logic of the subject in their own field. Chapters are provided which focus the attention of the reader on the related subjects of biochemistry, physical chemistry, pharmaceutical chemistry, dye chemistry and synthesis. An early introduction of the reader to the rules of nomenclature of the International Union of Chemistry, before contact with the various other systems, aids in avoiding some of the confusion which occasionally exists concerning the naming of compounds. The modern character of the volume is emphasized by the author's attempts to teach applications rather than innumerable facts. Thus the student is led into the development of a special sense for the prediction of reaction products rather than into a routine memorization of equations. A section of definitions, reference books and an index complete the text.—Willis R. Brewer.

Organic Chemistry in Pharmacy by Charles O. Wilson, Ph.D., Professor of Pharmaceutical Chemistry, College of Pharmacy, University of Texas; T. C. Daniels, Ph.D., Dean of Pharmacy, University of California; Ole Gisvold, Ph.D., Professor of Pharmaceutical Chemistry, College of Pharmacy, University of Minnesota; W. D. Kumler, Ph.D., Associate Professor of Chemistry, College of Pharmacy, University of California; Eldin V. Lynn, Ph.D., Professor of Chemistry, Massachusetts College of Pharmacy; Taito O. Soine, Ph.D., Associate Professor of Pharmaceutical Chemistry, College of Pharmacy, University of Minnesota; Abraham Taub, A.M., Professor of Pharmaceutical Chemistry, College of Pharmacy, Columbia University; and Heber W. Youngken, Jr., Ph.D., Associate Professor of Pharmacognosy, College of Pharmacy, University of Washington. Edited by Charles O. Wilson and Ole Grisvold. 1949. First Edition. 622 pages. J. B. Lippincott Company. $9.00.

Following an inspiring introduction, two chapters are devoted to preliminary consideration of the relationships between the physical properties of organic compounds and their physiological action and of the detoxication of compounds in the animal body. Chapters 4 through 16 deal with the organic chemistry of drugs falling into certain classifications based on their structures. Included are such classes as "Aliphatic and Cycloparaffin Hydrocarbons," "Aliphatic Halogenated Compounds," etc. Chapters 17 through 30 contain the chemistry of drugs classed together because of certain common qualities, even

though the members of the class may consist of different organic configurations. Typical of these chapters are the "Sulfur Compounds," "Dyes," "Vitamins," etc. The volume includes official and non-official drugs, a great number of structural formulas and equations, and completes each chapter with a list of references and selected supplemental reading topics.—Willis R. Brewer.

Pharmaceutical Selling, "Detailing," and Sales Training, by Arthur F. Peterson, B.S., Ph.C., Marketing and Management Committee. Formerly Sales Manager, Biologics Division, Heyden Chemical Corporation; Manager, Domestic Sales Division, Schering Corporation; District Manager, E. R. Squibb & Sons. First Edition, 1949. 374 pages. Illustrated. McGraw-Hill Book Company, Inc. Price $4.50.

It is a hopeful sign when men with broad basic training and extensive practical experience turn their energies and give of their time in the construction of books that apply basic knowledge to the practical problems of selling in a way that will be helpful to those who have already become engaged in pharmaceutical retailing and detailing; or whether, as students of pharmacy, they are preparing themselves to these fields. In the Preface, the author makes the statement,—"The book is intended especially (1) for pharmasists whose retail pharmacy experience has fostered the desire to examine pharmaceutical selling in its various phases, or to enter upon a career of selling or 'detailing' (Professional Service Pharmacy) in the service of a pharmaceutical products manufacturer; (2) for use as refresher material for those who already engaged in pharmaceutical selling and 'detailing'; (3) for use in pharmaceutical sales training courses; and (4) for teaching purposes in schools of pharmacy."

A perusal of the pages of the book shows the author has carried out his intention well. It is written in a style that makes it a pleasure to read, and the author illustrates his points in a pleasing, practical way that fixes them indelibly in the memory. Mr. Peterson's good common sense has been introduced to the readers of The American Journal of Pharmaceutical Education on previous occasions through its pages, and indubitably pharmaceutical educators will welcome this book as an aid to class room teaching.

Dental Anatomy, The Form and Function of the Permanent Teeth, by Robert C. Zeisz, D.D.S., F.A.C.D., F.I.C.D., formerly Associate Clinical Professor of Crown and Bridge Prosthesis; Chairman of the Division of Tooth Morphology and Applied Dental Anatomy, University of California

And

The Form and Function of the Deciduous Teeth, by James Nuckolls, D.D.S., F.A.C.D., Professor of Operative Dentistry; Chairman of the

Division of Preclinical Sciences; Chairman of the Section of Oral Pathology, University of California. 1949. 486 pages. 427 illustrations. The C. V. Mosby Company. Price $14.00.

The text deals with many details of tooth form, function, gross structure, and structural setting of both the deciduous and the permanent teeth. The authors have not attempted to include the histology, embryology, or general anatomy of the teeth or other oral structures which belong to other related but special fields. In the studies upon which the text is based, the authors have had at their command thousands of teeth of both types, and from these a composite tooth of each type has been constructed which gives a picture of an "ideal tooth." A glossary is included which gives a long list of special terms which are used in the text where words have a technical meaning in dentistry and which may not be emphasized in our general medical dictionaries. Such a glossary in a special field is always an asset to a text. The mechanics of the text are exceptional. This is a text that should be in every medical and pharmaceutical library.

The Art of Coating Tablets, by T. H. Rowell, Pharmaceutical Chemist, Baudette, Minnesota, 1949. 33 pages. Illusrated. Published by the author. Price $3.00.

The author being a chief chemist of a manufacturing firm was set to the task of developing a process for coating tablets. Most processes for coating are factory secrets. Textual material in this field is limited and of a positive rather than of a negative nature in that one is told what to do and is not told what **not** to do. Using this as a basic principle, the author describes coating equipment and discloses the methods of preparing the tablets, subcoating, sugar coating, coloring and finishing, polishing, enteric coating, reclaiming ruined tablets, and closes with comments on general instructions and general precautions.

A Concise Laboratory Manual & Atlas for Comparative Anatomy, by W. H. Atwood, Head of the Department of Biology, Milwaukee State Teachers College. 1949. 155 pages with 55 illustrations, 39 of which are full page plates. The C. V. Mosby Company. Price $2.75.

A well written laboratory guide covering the usual forms studied in standard courses. The illustrations are largely line drawings and admirably outline the organs and show their relationships clearly.

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PUBLICITY FOR AMERICAN FOUNDATION FOR PHARMACEUTICAL EDUCATION SCHOLARSHIPS

Under date of November 1, 1949, Dr. E. L. Newcomb, Secretary and Managing Director of the American Foundation for Pharmaceutical Education addressed a letter to all deans of colleges of pharmacy containing a plea for cooperation in connection with local and regional publicity on the granting of undergraduate scholarships and graduate fellowships by the Foundation.

The Executive Committee wishes to endorse Dr. Newcomb's request and to urge every member college to give complete and adequate publicity to the conferring of all Foundation awards. The selection of a student for a fellowship or scholarship is an honor which deserves recognition from the public; such publicity reflects credit upon an institution; and most of all, such notices may be extremely useful in attracting the interest and support of potential donors to the American Foundation for Pharmaceutical Education.